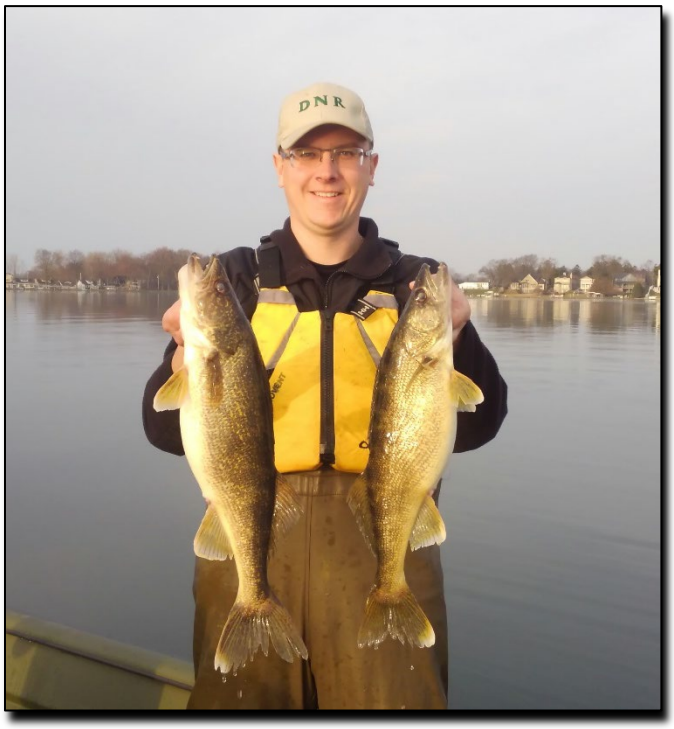
Indiana
Walleye Strategic Plan
2019-2023



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Cover photo: Division of Fish and Wildlife fisheries biologist Tom Bacula holds Walleyes collected during a survey of Lake Maxinkuckee (Marshall Co.) in April 2019.

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MANAGEMENT HISTORY

Walleye (*Sander vitreus*) are a native species to North America where they inhabit waters throughout the St. Lawrence-Great Lakes, Arctic, and Mississippi River basins from Quebec to Northwest Territories, and south to Alabama and Arkansas.[1,2] Geographically, they are the most ubiquitous and successful freshwater top predator in North America.[2] As a cool-water species Walleye prefer water temperatures less than 73°F with oxygen levels greater than 3.0 ppm. In Indiana, Walleye are native to the Lake Michigan, Kankakee and Ohio River systems and their tributaries. However, stocking has increased their distribution throughout the state. At least 100 different locations have been stocked with Walleye over the past century resulting in ubiquitous statewide distribution. River systems are primarily sustained through natural reproduction, although some direct stockings and emigration from glacial lakes or reservoirs contribute to those populations. Among glacial lakes and reservoirs, some low level natural reproduction occurs but it is likely below the levels required to sustain sport fisheries. Walleyes need course substrates (e.g., gravel to cobble) on wind swept shorelines to successfully spawn with an optimal water temperature of 46°F.[2] A minimal amount of this habitat exists in Indiana's Walleye waters.

The history of Walleye stocking in Indiana began in the early 1900's when eggs were obtained from a federal source and raised to fry in a state facility.[3] However, the stockings were generally unsuccessful and the Walleye program was abandoned in the 1940's. The 1970's saw new opportunities for Walleye with the construction of several large reservoirs and expansion of the hatchery program.[4] The Division of Fish and Wildlife (DFW) began developing its own wild broodstock at Brookville Reservoir (Franklin and Union Co.) using an out-of-state source for eggs and fry. At least one other lake was investigated for broodstock potential, Lake Maxinkuckee was evaluated and had the potential to produce 5 million eggs annually, but poor survival of stocked fish in two consecutive years eliminated its use.[5] Therefore, Brookville Reservoir remains the state's only brood source location and Indiana's Walleye program hinges upon its success.

Since 1970, there have been over 706 million fry, 43 million spring fingerlings (1.5-2 in), and 150,000 fall advanced fingerlings (5-8 in) stocked by the DFW at 66 different glacial lakes, reservoirs, or streams. In addition to state-grown Walleyes, there have been 9,000 spring fingerlings and 626,200 fall advanced fingerlings stocked from private hatchery sources for state requested stockings. Walleye are the most popular species for private permitted stockings in Indiana waterbodies, from 2014-2018 they were requested 61% of the time. The Indiana Walleye program continues to undergo refinements in stocking rates, sizes, and locations. The current

[1] Simon, T. P. 2011. Fishes of Indiana: a field guide. Indiana University Press, Bloomington, Indiana.
[2] Barton, B. A., editor. 2011. Biology, management, and culture of Walleye and Sauger. American Fisheries Society, Bethesda, Maryland.
[3] Miles, G. W. 1915. Hatching the wall-eyed pike. Pages 39-48 *in* Biennial report of the commissioner of fisheries and game in Indiana.
[4] Andrews, S., et al. 1993. Walleye management in Indiana: Current problems and strategies. Indiana Department of Natural Resources, Division of Fish and Wildlife report. Indianapolis, IN. 39 pp.
[5] Shipman, S. T. 1992. Walleye population size, exploitation, broodstock potential and impact of harvest restrictions at Lake Maxinkuckee. Indiana Department of Natural Resources, Division of Fish and Wildlife report. Indianapolis, IN. 46 pp.

Walleye program based on 2017 and 2018 stocking records indicate State hatcheries raised or purchased fish for stockings of: fry at four reservoirs; spring fingerlings at five glacial lakes, six reservoirs, and one river; and advanced fingerlings at seven glacial lakes and one reservoir.

In the 1970's and 1980's many lakes had experimental fry and fingerling stockings from various in and out of state sources. By 1987, biologist developed a Walleye stocking ranking system based on multiple criteria including lake size, storage ratio, depth, fish community, previous stocking success, and professional judgement to refine Walleye stocked locations.[4,6] In 1994, lakes were divided into successful, transitional, and no longer stocked lakes for Walleye program lakes classification.[7] Recommended stocking rates put in place in 1994 were 3,000 fry per acre and 100 fingerling per acre at a maximum, while lakes with historical slow growth have reduced stocking rates. The target hatchery production goal is 30 million fry and one million fingerlings. Following stocking at the recommended rates, lakes are evaluated for stocking success with fall electrofishing. Stocking is deemed successful if age-0 Walleye catch meets or exceeds 7 fish per hour in at least two out of three years from the initial stocking, otherwise the stocking was discontinued.[6] If successful, the evaluation then shifts to harvest success at the end of the sixth stocking year. A successful Walleye fishery occurs when either: (1) the level of harvest meets or exceeds one Walleye or pound of Walleye per acre; or (2) at least 5% of the anglers target Walleye and the targeted angler catch rate is at least 0.1 Walleye per hour.[7] Since 2001, lakes that occasionally met the success criteria were tried with an experimental use of advanced fingerlings at stocking rates from 10 to 20/ac to meet success criteria and increase angler interest.[8]

Walleyes typically reach 14 and 16 inches by age 2 and 3, respectively. Growth of male fish substantially slows after age 5, whereas female growth slows after age 6. Walleyes aged from Brookville Reservoir (Franklin and Union Co.) indicated the oldest male was an age-7 fish measuring 22 inches, while the oldest female was a 27 inch age-8 fish.[9] Walleye growth is related to water temperature with optimal growth at 72°F, while the upper lethal temperature is 88°F.[2] The Indiana state record Walleye is shared by two 14 pound, 4 ounce fish caught in 1974 (Leon Richart, left) and 1977 (Donald Tedford, right) from the Kankakee (Lake Co.) and Tippecanoe (Pulaski Co.) Rivers, respectively.

[6] Shipman, S. T. 1991. Determination of Walleye year class strength utilizing standardized fall electrofishing techniques. Indiana Department of Natural Resources, Division of Fish and Wildlife. Indianapolis, IN. 32 pp.
[7] James, B., et al. 1994. Fisheries section staff response to Walleye committee recommendations. Indiana Department of Natural Resources, Division of Fish and Wildlife. Indianapolis, IN. 9 pp
[8] Grier, A. C. 2008. Advanced Fingerling Walleye. Indiana Department of Natural Resources, Division of Fish and Wildlife. Indianapolis, IN. 86 pp.
[9] Donabauer, S. B. 2010. Comparing otoliths, dorsal spines, and scales to estimate age, growth, and mortality between male and female Walleye from Brookville Reservoir, Indiana. Indiana Department of Natural Resources, Division of Fish and Wildlife. Indianapolis, IN. 59 pp.

Figure 1. Indiana state record Walleye 14 pound, 4 ounce fish caught by Leon Richart (left) in 1974 from the Kankakee River (Lake Co.) and by Donald Tedford (right) by 1977 from the Tippecanoe (Pulaski Co.) Rivers.

Prior to 1961, Walleye were regulated by a closed fishing season (May 1 – June 15), a 15-inch minimum size limit, and a six (6) fish daily bag limit (Table 1). Since 1961, there has been an open season for all waters. The Ohio River has been regulated in conjunction with Kentucky since 1985 with a 10 fish daily bag limit (1985 – present), a 15-inch minimum size limit (1985 – 1994), and now there is no minimum size limit (1995 – present; Table 2). For waters other than the Ohio River, the daily bag limit for Walleye has remained at six (6) fish per day, but included Sauger (1970 – present) and Saugeye (1985 – present) singly or in aggregate. The 15-inch minimum size limit was removed from 1961 to 1997. A statewide minimum size limit of 14-inches was established in 1997 with the exception of no minimum size limit at Sullivan Lake (Sullivan Co.; 1997 – 2005). Sullivan subsequently realigned with the statewide minimum size of 14 inches (2006 – present). There was a 15-inch minimum size limit at the St. Joseph River (St. Joseph and Elkhart Co.) from 1997 to 2006. Wall Lake (LaGrange Co.) has had a 16-inch minimum size limit and a two fish daily bag limit since 2014. A major regulation change occurred in 2016 with Walleye north of State Road 26 having a 16-inch minimum size limit (exceptions: Bass Lake (Starke Co.), Wolf Lake (Lake Co.) a 14-inch minimum size limit; and Lake George (Steuben Co.) a 15-inch minimum size limit). Waters south of State Road 26 are still under a 14-inch minimum size limit and there is still the statewide six (6) Walleye daily bag limit, singly or in aggregate with Sauger and Saugeye (312 IAC 9-7-12).

Table 1. Statewide and regional Walleye regulations.

Time Period	Scope	Minimum Size	Daily Bag Limit	Closed Season
Prior to 1961	Statewide	15 inches	6	May 1 - June 15
1961 to 1969	Statewide	none	6	none
1970 to 1984	Statewide	none	6*	none
1985 to 1996	Statewide	none	6**	none
1997 to 2015	Statewide	14 inches	6**	none
2016 to present	South of SR 26	14 inches	6**	none
2016 to present	North of SR 26	16 inches	6**	none
*Singly or in aggregate bag limit of Walleye and Sauger				
**Singly or in aggregate bag limit of Walleye, Sauger, and Saugeye				

Table 2. Special regulations different from statewide or regional regulations.

Water Body	Time Period	Minimum Size	Daily Bag Limit	Closed Season
Ohio River**	1985 to 1994	15 inches	10	none
	1995 to present	none	10	none
St. Joseph River**	1997 to 2015	15 inches	6*	none
Sullivan Lake	1997 to 2005	none	6*	none
	2006 to present	14 inches	6*	none
Wall Lake	2014 to present	16 inches	2	none
Bass Lake	2016 to present	14 inches	6	none
Lake George**	2016 to present	15 inches	6	none
Wolf Lake**	2016 to present	14 inches	6	none
*Singly or in aggregate bag limit of Walleye, Sauger, and Saugeye				
** Regulations adopted to align regulations across multiple jurisdictions				

POPULATION STATUS

Walleye are a stocked predator in Indiana's glacial lakes and reservoirs. While, there is natural reproduction in some locations, stocking is necessary to sustain those fisheries (Table 3). Within rivers and streams, populations are generally self-sustaining or supplemented by emigration from lakes and reservoirs that create angling opportunities (i.e., tailwater fisheries). Only one tailwater fishery below Freeman Lake (Carrol Co.) at Oakdale Dam on the Tippecanoe River is sustained via direct stocking into the river. Contribution of these stocked fish has not been formally evaluated. Walleye escapement, especially during high water conditions has been documented. In Rathbun Lake, Iowa annual escapement was 14% for fish larger than 12 in.[10] Similarly, six of the 39 (15%) tagged Walleyes escaped in a movement study at Monroe Reservoir.[11] It is unknown

[10] Weber, M. J., M. Flammang, and R. Schultz. 2013. Estimating and evaluation mechanisms related to Walleye escapement from Rathbun Lake, Iowa. North American Journal of Fisheries Management 33(3):642-651.
[11] Clark-Kolaks, S. 2009. Distribution and movement of Walleye (*Sander vitreus*) in Monroe Reservoir, Indiana 2008 and 2009. Indiana Department of Natural Resources, Division of Fish and Wildlife. Indianapolis, IN. 28pp.

how this impacts the stocked fisheries, but annual stocking practices appear to moderate year-class variation where fisheries are maintained.

Table 3. Summary details of currently (2017-2018) DFW-stocked Walleye waters in Indiana.

Waterbody	County	Resource Type	Acres	Size	Requested N/Acre	Stocked N/Acre[a]	N Stocked[a]	Initial Year
Bass	Starke	Glacial Lake	1,345	Fingerling	50	50	49,733[b]	1980
Brookville	Franklin	Reservoir	5,260	Fry	2,000	2,009	10,567,362	1974
Cagle's Mill	Owen	Reservoir	1,400	Fingerling	60	63	88,400	1972
Clear	Steuben	Glacial Lake	800	Fingerling[d]	100	30	23,942	1974
				Fall Fingerling[e]	10	10	8,000	
Crooked	Steuben	Glacial Lake	828	Fall Fingerling	10	10	8,020[b]	1977
Eagle Creek	Marion	Reservoir	1,350	Fingerling	60	39	53,283	1997
Kokomo	Howard	Reservoir	484	Fingerling	50	36	17,530	1997
Lake-of-the-Woods	Marshall	Glacial Lake	416	Fingerling	50	63	26,414	1990
Little Turkey	LaGrange	Glacial Lake	135	Fall Fingerling	10	24	3,276	2012
Maxinkuckee	Marshall	Glacial Lake	1,854	Fingerling[e]	100	93	172,435	1975
				Fall Fingerling[d]	10	10	17,798	
Mississinewa[c]	Wabash	Reservoir	3,180	Fry	surplus	-	493,500	1993
Monroe	Monroe	Reservoir	10,750	Fry	600	728	7,830,200	1973
Patoka	Dubois	Reservoir	8,800	Fry	600	827	7,275,600	1978
Pike	Kosciusko	Glacial Lake	203	Fingerling	50	64	13,016	1988
Prairie Creek	Delaware	Reservoir	1,275	Fingerling	50	29	36,483	2001
Pretty	LaGrange	Glacial Lake	184	Fall Fingerlings[d]	10	1	136	1990
Shafer	White	Reservoir	1,281	Fingerling	100	94	120,148[b]	1992
Shriner	Whitley	Glacial Lake	120	Fall Fingerling	10	10	1,200[b]	2016
Summit	Henry	Reservoir	835	Fingerling	50	24	19,979	1999
Sylvan	Noble	Reservoir	630	Fall Fingerling	10	9	5,490[b]	1985
St. Joseph River	St. Joseph	River	-	Fall Fingerling[e]	-	-	9,260	1995
Tippecanoe River	Carroll	River	18.6 River Miles	Fingerling	-	-	25,073[b]	1983
Wall	LaGrange	Glacial Lake	141	Fall Fingerling	10	10	1,410	2009
Winona	Kosciusko	Glacial Lake	562	Fall Fingerling	10	10	5,620[b]	1986
Total			41,833	Fry	22,738,000	-	25,673,162	-
				Fingerling	811,400	-	646,436	
				Fall Fingerling[d]	43,190	-	45,465	
				Fall Fingerling[e]	40,200	-	40,747	

[a] *Average of 2017 and 2018 stocking*

[b] *2017 stocking year only*

[c] *2018 stocking year only, fry are stocked and reared in a 10 ac pond that is then emptied to the reservoir*

[d] *Even year stocking*

[e] *Odd year stocking*

In glacial lakes, Walleyes were detected at 18% of all lakes surveyed during the 2010 to 2014 Glacial Lakes Status and Trends sampling.[12] Glacial lakes detection level was higher than expected (8%) due to channel connections with known stocked lakes and possible illegal stockings. The Impoundment Status and Trends project started in 2016, thus detection rates for Walleyes have not yet been calculated. [13] An expected detection level for Walleyes at reservoirs would be 12% due to current stocking locations. However, this rate may be higher since some reservoirs had been stocked historically and therefore, may have a low population abundance or through emigration or immigration of Walleye since some reservoirs are fed by or feed rivers with known Walleye populations (e.g., Lake Freeman).

Indiana's stocked Walleye fisheries have traditionally been evaluated using fall (September 15 to October 31) DC, night electrofishing at random transects proportional to lake area since the late 1980's.[6] DFW has conducted hundreds of surveys throughout the state with the stocking success criteria of 7 age-0 fish per hour. Advanced Walleye fingerlings success criteria for age-1 Walleye is 4.2 fish per hour as they cannot be evaluated with age-0 criteria.[7] The age-0 and -1 Walleye stocking survival surveys are effective in the smaller northern Indiana waters, but have limited utility in the larger southern Indiana reservoirs, overall are not successful in characterizing adult populations. As a result, gill nets were occasionally used in the fall to index larger and presumably older fish, but with inconsistent results. For example, at Monroe Reservoir in 2018 gill nets were used in an attempt to collect adults, but the catch rate was only 0.9 fish per net lift.[14] By utilizing the fall age-0 and -1 indices, many fry and fingerling lakes were discontinued despite the likelihood of successful Walleye survival. This trend led to a tactical program change in 2001 when DFW experimentally purchased fall advanced fingerling Walleyes to enhance three northern Indiana lakes, additionally a privately funded stocking program at Simonton Lake was evaluated.[8] Walleyes stocked at larger sizes increased survival and improved these fisheries. Given the success, stocking of fall fingerlings has expanded to other lakes where needed and feasible. A benchmark for program analysis was 2001 which coincides with Northern stocking of fall advanced fingerlings.

Since 2001, there have been at least 193 fall Walleye stocking evaluations conducted at glacial lakes and reservoirs (Table 4). The longest annual evaluation has been at Pretty Lake (Lagrange Co.) for 17 consecutive years (2001 – 2017), while other surveys were only conducted a few times in sporadic years. For the purpose of program analyses, only DFW stocked lakes (hatchery and commercially produced) are included. The median (interquartile range, throughout) catch rate (number/hour) for age 0, 1, and 2+ Walleyes from 119 glacial lake surveys is 5.6 (0.7-14.8), 6.8 (1.5-13.5), and 4.6 (1.7-10.7), respectively. Median Walleye catch for ages 0, 1, and 2+ from 74 reservoir surveys is 11.3 (2.6-27.8), 4.0 (1.0-11.5), and 1.3 (0.5-5.1), respectively.

[12] Donabauer. S., M. Porto, and T. Leverman. 2014. Status and trends of Indiana glacial lake fish communities: spatial and temporal variation of species-specific detection probabilities. Indiana Department of Natural Resources, Division of Fish and Wildlife. Indianapolis, IN. 128pp.
[13] Clark-Kolaks, C. 2016. Indiana status and trends impoundments sampling guidelines. Indiana Department of Natural Resources, Division of Fish and Wildlife. Indianapolis, IN. 6pp.
[14] Kittaka, D. 2018. Monroe Lake Walleye, Hybrid Striped Bass stocking evaluation and Channel Catfish survey 2018. Indiana Department of Natural Resources, Division of Fish and Wildlife. Indianapolis, IN. 2 pp.

Table 4. Catch-per-unit-effort (CPUE; N/h) by age class of Walleye based on the most recent surveys (2010-2018) using fall electrofishing. Quartile summaries for glacial lakes and reservoirs include all surveys on all DFW stocked lakes 2001 to 2018.

				CPUE (N/h Fall Electrofishing)		
Lake	County	Resource Type	Year	Age 0	Age 1	Age 2+
Bass	Starke	Glacial Lake	2016	9.0	1.3	4.5
Bass	Starke	Glacial Lake	2017	1.5	2.0	0.5
Big Turkey	Steuben	Glacial Lake	2010	*	6.0	0.5
Clear	Steuben	Glacial Lake	2017	5.3[a]	2.3	4.0
Clear	Steuben	Glacial Lake	2018	4.3	13.0	2.5
Crooked	Steuben	Glacial Lake	2015	0.5[a]	20.0	8.5
Crooked	Steuben	Glacial Lake	2016	*	16.5	13.0
Lake-of-the-Woods	Marshall	Glacial Lake	2015	24.8	8.8	11.8
Lake-of-the-Woods	Marshall	Glacial Lake	2017	7.5	4.3	32.5
Maxinkuckee	Marshall	Glacial Lake	2017	6.5	1.0	0.3
Maxinkuckee	Marshall	Glacial Lake	2018	0.8	1.5	1.3
Pike	Kosciusko	Glacial Lake	2014	12.0	29.0	19.0
Pretty	Lagrange	Glacial Lake	2016	*	26.0	2.0
Pretty	Lagrange	Glacial Lake	2017	*	0	14.0
Shriner	Whitley	Glacial Lake	2017	*	20.3	*
Shriner	Whitley	Glacial Lake	2018	*	10.7	14.1
Wall	Lagrange	Glacial Lake	2015	*	14.0	10.7
Wall	Lagrange	Glacial Lake	2017	*	0.7	14.0
Winona	Kosciusko	Glacial Lake	2017	*	7.7	20.0
Brookville	Franklin	Reservoir	2015	38.0	0	2.8
Cagle's Mill	Owen	Reservoir	2014	11.3	4.5	0.3
Eagle Creek	Marion	Reservoir	2010	52.7	+	+
Eagle Creek	Marion	Reservoir	2014	22.5	9.0	9.0
Kokomo	Howard	Reservoir	2015	5.3	7.7	2.3
Monroe	Monroe	Reservoir	2017	0.2	0.9	0.5
Monroe	Monroe	Reservoir	2018	0	0	1.3
Patoka	Dubois	Reservoir	2016	2.0	0.6	0
Patoka	Dubois	Reservoir	2018	3.5		
Prairie Creek	Delaware	Reservoir	2013	7.5	+	+
Summit	Henry	Reservoir	2014	13.0	5.0	2.5
Sylvan	Noble	Reservoir	2014	*	38.0	30.8
Sylvan	Noble	Reservoir	2016	*	18.5	25.5
Glacial Lakes (N = 119)			1st Quartile	0.7	1.5	1.7
			Median	5.6	6.8	4.6
			3rd Quartile	14.8	13.5	10.7
Impoundments (N = 74)			1st Quartile	2.6	1.0	0.5
			Median	11.3	4.0	1.3
			3rd Quartile	27.8	11.5	5.1

* Not present due to stocking strategy

+ Catch was combined for gill nets and electrofishing

[a] Natural reproduction (excluded from quartile summaries)

To better assess the adult Walleye population, spring trap netting surveys have been conducted in northern Indiana lakes with the first survey in 2008 at Crooked Lake (Steuben Co.). There have been 12 spring surveys conducted (Table 5), although there has been broad variation in procedures; therefore, catch comparisons should be viewed cautiously. To promote consistency, a 2015 interim sampling procedure for glacial lakes was adopted that specifies the use of only small Lake Michigan style trap nets (SLM nets), defines the number of net-lifts required per lake, and specifies collection procedures including sex-specific information and aging fish from otoliths instead of scales (T. Bacula, 2015 Interim Walleye sampling strategy for glacial lakes). Overall, the median catch was 14.0 (4.8 to 25.3) fish/net lift with netting effort ranging from four to 52 net lifts. Generally, fish less than stock length (10 inches) are not vulnerable to the spring netting, but are occasionally collected (less than 0.5% of the total spring catch). Walleye catch was standardized to 12 net lifts following the 2015 interim guidance, but there has been a mix of large Lake Michigan style and SLM trap nets included, so again, catch comparisons should be viewed cautiously. The median catch (fish per net lift) and interquartile range for stock-size (10-15 in), quality-size (15-20 in), preferred-size (20-25 in), and memorable-size (25-30 in) Walleye was 25 (8-101), 115 (45-165), 5 (3-8) and 0 (0-2), respectively. No trophy-sized (> 30 inches) Walleye have been collected. For all surveys, catch was separated by sex due to differences in age and growth between the sexes. Overall 79% of the catch was male, 18% were females, and 3% were immature or unknown. The median standardized catch of male Walleye was 125 (40-183) fish, while female catch was 22 (16-55) fish.

Table 5. Catch-per-unit-effort (CPUE; N/lift) for all Walleyes collected and by size class and sex of Walleyes based on 12 trap net lifts for all spring trap nets since 2008.

					N (Standardized to 12 trap net lifts)								
					< Stock	Stock	Quality	Preferred	Memorable	Trophy	Sex		
Lake	County	Resource Type	Year	CPUE	(< 10 in)	(10 - 15 in)	(15 - 20 in)	(20 - 25 in)	(25 - 30 in)	(30+ in)	Male	Female	Imm./Unk
Crooked	Steuben	Glacial Lake	2008	14.5	0	9	162	3	0	0	108	57	9
Wall	Lagrange	Glacial Lake	2009	25.8	0	132	174	3	0	0	174	111	24
Pretty	Lagrange	Glacial Lake	2010	2.9	0	9	16	8	2	0	16	8	10
Sylvan	Noble	Reservoir	2011	25.2	0	183	109	8	2	0	209	77	16
Crooked	Steuben	Glacial Lake	2012	14.2	1	44	120	5	0	0	143	18	9
Maxinkuckee	Marshall	Glacial Lake	2012	5.0	5	3	46	5	0	0	41	16	2
Wall	Lagrange	Glacial Lake	2013	4.4	0	6	41	5	2	0	36	17	0
Pike	Kosciusko	Glacial Lake	2014	1.9	0	4	15	3	0	0	16	3	3
Winona	Kosciusko	Glacial Lake	2014	29.6	0	91	209	50	4	0	291	54	9
Lake-of-the-Woods	Marshall	Glacial Lake	2015	13.8	1	33	126	6	0	0	142	23	1
Bass	Starke	Glacial Lake	2016	7.3	1	17	69	2	0	0	67	21	1
Sylvan	Noble	Reservoir	2016	36.5	3	179	229	23	4	0	378	54	6
			1st Quartile	4.8	0	8	45	3	0	0	40	16	2
			Median	14.0	0	25	115	5	0	0	125	22	8
			3rd Quartile	25.3	1	101	165	8	2	0	183	55	10

ANGLER STATUS

Walleyes ranked sixth among the anglers top three most popular sport fish in the 2017 Licensed Angler Survey (LAS),[15] stimulating nearly $32 million of annual economic activity (Appendix A). Walleye provide approximately 23,000 anglers with nearly 100,000 angler-days. In the 2017 LAS, Walleye management was the third highest species priority for anglers who fish in natural lakes

[15] Responsive Management. 2017. Indiana anglers' fishing participation and their opinions on fishing management issues. Responsive Management National Office. Harrisburg, VA. 228 pp.

(33%), reservoirs (28%), and rivers and streams (21%). Overall, Walleye was the top selected species (40%) that anglers would prefer to see stocked.

The glacial lakes Status and Trends creel design launched in 2015 is useful for examining landscape trends in angling and harvest; however, three state stocked lakes have thus far been included in the creel. Bass Lake (Starke Co.), Round/Clear (Steuben Co.), and Winona Lake (Kosciusko Co.) had angler Walleye preferences of 22, 7, and 38%, respectively. Collectively the preference for Walleye among these three creels was 28%. Throughout DFW management history a variety of angler creel surveys have been conducted to document angler harvest. Many were conducted following original procedures to determine if anglers were targeting and harvesting the stocked fish.[16] These creel evaluations were conducted within three years after the lake was deemed successful for stocking, by the end of the sixth year a decision to retain or drop the lake is made. The angling criteria for a successful Walleye fishery is: (1) the harvest of one fish or pound per acre; or (2) a minimum of 5% Walleye angler preference and a minimum catch rate of 0.10 fish per hour.[6] Overall, 20% of anglers were fishing for Walleyes at stocked northern Indiana lakes from 1995 to 2013, while 5% of anglers targeted Walleyes at southern Indiana reservoirs. A thorough summary of historical creel information is needed to examine the success criteria. Many rivers and tailwaters contain Walleyes and are highly sought seasonally, but few surveys have been conducted. A 2002 angler survey of the Kankakee River found 11% of anglers targeted Walleyes and harvested 329 fish (7% of total survey harvest), whereas, in a 1999 creel of the Tippecanoe River found that no Walleye anglers or harvest were documented despite many watershed lakes that were stocked. [17,18]

The popularity of Walleye for entries into the Fish of the Year and Record Fish program in recent years represents the progression and popularity of Walleye fishing in Indiana. The current State Record Walleye had been broken twice in 1963 and 1969 before the current record of 14 lb. 4 oz. was confirmed in 1974 and subsequently tied in 1977. Since 1963 there have been 92 Walleye entered into the Fish of the Year program. Thirty-four percent of entries were caught from rivers, followed by 30% from reservoirs, 20% from Lake Michigan and 13% glacial lakes. Only 9% of entries were preferred (20-25 inches) size while 68% were memorable (25-30 inches) and 22% were trophy (>30 inches) size Walleye. The program popularity grew from only 25 entries from 1963 to 1999, to nearly 3 entries per year from 2000 through 2016 (N=46). Interestingly, 2017 and 2018 saw 23% of the total entries (N=21) from 14 different locations including several from non-stocked lakes.

PROGRAM ANALYSIS

Walleye are the most popular stocking-dependent sport fish according to the 2017 LAS. Additionally, Walleye are the most popular fish anglers would like to see stocked. In 2016, the

[16] Ball R., et al. 2006. Indiana Creel Methods. Indiana Department of Natural Resources, Division of Fish and Wildlife. Indianapolis, IN. 78 pp.
[17] Price, J. and B. Robertson. 2005. Fishery, habitat, and recreational use surveys for the Kankakee River, Indiana. Indiana Department of Natural Resources, Division of Fish and Wildlife. Indianapolis, IN. 31 pp.
[18] Brindza, N. 2001. Tippecanoe River, recreational survey report, summer 1999. Indiana Department of Natural Resources, Division of Fish and Wildlife. Indianapolis, IN. 4 pp.

DFW spent $420,708 to supply and maintain (primarily stocking and population assessments) fishable Walleye waters throughout the state. Statewide, Walleye anglers account for almost 5% of all anglers, which generates $588,562 of annual revenue to the DFW (Appendix A and B). Thus, the current Walleye supply:demand ratio is 0.72:1, which is well below the 2.5:1 cool-water target to create diverse sport fishing opportunities. While many opportunities for Walleye anglers exist statewide, potential exists to improve program efficiency and geographic distribution of this popular sport-fish. This document focuses on DFW stockings, however numerous conservation groups engage in privately funded Walleye stocking efforts at waters beyond the DFW program. Such efforts can create quality Walleye fishing opportunities beyond what the Division can accomplish on its own. It is important to assist these groups with technical expertise, regulate stockings for maximum benefit, and acknowledge the contributions of cooperative partners whenever possible.

Hatchery production is a critical component of Indiana's Walleye program. Currently, all state hatchery produced fish originate from Brookville Reservoir where brood fish are netted along the rip-rap dam face. Adaptations to conditions in Brookville Reservoir and the methods of brood fish collection may influence the fitness of hatchery produced Walleye for stocking in other locations such as glacial lakes. Walleyes utilize different spawning strategies even within the same waterbody. Often fish utilize the lake then spawn in the river, or live and spawn entirely in the lake.[2] It is unlikely that sufficient natural reproduction is occurring in Indiana's lakes to sustain sport fisheries, but brood collection procedures and a single source population may impact success of other stocked fisheries (glacial lakes, reservoirs, and rivers). To determine the natural reproduction contribution to the sport fishery it may be beneficial to evaluate the contribution by marking stocked fish. Augmentation of suitable Walleye spawning habitat for natural reproduction to supplement stocking efforts may be important to boost recruitment in a few locations. Brookville Reservoir has been successfully used for over 30 years for collecting brood fish, but disease, population declines, or other unforeseen issues could result in obstacles to Walleye production. Thus, to ensure long-term Walleye production remains feasible, identification of an alternate brood source should be identified.

The Walleye program continues to evolve from a few fry-stocked lakes to intensively managed lakes stocked with fall fingerlings. State hatcheries have consistently been able to annually supply fry and spring fingerling stocking requests, but are limited on production capacity for fall fingerlings. As a result, commercial producers have supplied between 32 and 40 thousand advanced fingerlings annually since 2001 for fall stockings. In recent years, there is an increased demand by biologists for fall fingerlings to fulfill the stocking desires of anglers. Currently, advanced fingerlings are stocked in northern Indiana primarily from a hatchery in central Wisconsin (90% in 2017 and 2018) and supplemented by in-state hatchery (10% in 2017 and 2018) production. Undoubtedly, the size of stocked fish has shown favorable outcomes pertaining to survival, but there may be genetic adaptions to northern Indiana that impact stocking success or adult natural reproduction. Twenty-three lakes are currently stocked with Walleyes out of the 66 lakes that were once deemed unsuccessful. Currently, scarce resources limit some fall fingerling stockings to alternate years and prohibit expansion to other lakes. It is reasonable to expect future projections for advanced fingerling requests to be at least 90,000 fish as more lakes transition to the stocking of larger sized Walleye. Figuring out how these extra fish are obtained should be a

DFW priority. The economic benefits attributed by Walleye fishing warrants enhancement of hatchery production to those levels.

As opportunities to expand and refine the program arise, decisions regarding appropriate locations to develop Walleye fisheries must be thoughtful and informed. The 2018 tropic status distribution for hypereutrophic, eutrophic, mesotrophic and oligotrophic Walleye lakes is 5, 57, 9 and 29%, respectively.[19] Currently, in northern Indiana three lakes do not contain cool-water habitat in late August and eutrophication may further decrease lakes with suitable habitat. A structured assessment process should be used to guide decisions by updating the 1987 Walleye stocking feasibility criteria that also includes key factors such as habitat characteristics, water quality, prey community, angler desires, and geographic location. Utilizing the Midwest Glacial Lakes Partnership conservation planner (http://midwestglaciallakes.org/resources/conservationplanner/) will be a useful tool to help select suitable Walleye locations. Furthermore, within current program lakes an adaptive management approach for changing stocking rates, size, or periodicity (annual or biennial) may improve Walleye populations. Minimal experimental changes and evaluations have occurred in the aforementioned criteria unless fish were needed at another location or a hatchery production shortage occurred that may further refine the program. Angler desires for Walleye fisheries must be incorporated into the decision process. Results from the 2017 LAS angler preference indicate 16, 13, and 10% of anglers preferred Walleye in glacial lakes, rivers and streams, and reservoirs, respectively. Overall, there is a stronger following for Walleye in northern and central Indiana than southern Indiana.[15] Currently, three lakes in Indiana are stocked with saugeye, a Walleye X Sauger hybrid produced in state hatcheries. This hybrid maybe a better alternative for certain locations that did not meet the Walleye habitat or stocking evaluation criteria, but additional angling opportunity is desirable.

The DFW has monitored stockings through fall evaluations of immature fish, but the criteria has not been updated since 1991.[6] Nearly 20 additional years of data have been collected since the original success criteria were formulated and questions have been raised as to whether the current electrofishing standard of 7 fish per hour for age-0 Walleye is still a sufficient threshold to define success. Some of the major changes in stocking that have occurred is a decrease in the standard stocking rate (e.g., 3,000 to 1,000 fry per acre) and increased use of advanced fingerlings. Regarding stocking rates, there are concerns that the evaluation criteria were established for fully requested stocking rates. Upon review of Table 3, few lakes received the full requested target stockings. This leads to high variability in statewide comparisons for defining a "successful" stocking, let alone differences between glacial lakes and reservoirs. Moreover, the current criteria measured success with fry and fingerling stockings and not advanced fingerlings. These fish are more costly to stock due to hatchery rearing requirements and purchasing from a commercial source, thus the DFW should consider higher catch rate criteria. Most lakes stocked with advanced fingerlings in Table 4 such as Crooked, Shriner, and Sylvan Lakes far exceed (16.5, 10.7, and 18.5 fish per hour, respectively) the 4.2 fish per hour catch rate established for age-1 fish with the fall fingerling stocking program. Furthermore, the reservoir median age-0 catch also exceeded (11.3 fish per hour) the 7 fish per hour criteria.

[19] Indiana Department of Environmental Management (IDEM). 2018. Integrated water monitoring and assessment report: Appendix K: Trend and trophic status of Indiana's Lakes. Indiana Department of Environmental Management. Indianapolis, IN. 20 pp.

In 2016, the Walleye regulation was changed for many northern Indiana lakes to a 16.0 inch size limit partially to allow the fall advanced Walleye an additional year of growth. This change in size regulation has not been evaluated, but some preliminary data was collected with spring trapping. In addition to electrofishing catch, gill netting has been infrequently used to assess the larger fish and more recently spring trap netting. The 2012 to 2016 statewide percid work plan calls for gill netting and trap netting to assess the larger fish, in addition to age 0 and 1 fall electrofishing.[20] These adult assessments have been executed inconsistently in some locations and not done at all at other waters; nevertheless, these surveys offer the most practical information to anglers for the fish they target and derive the greatest satisfaction from pursuing. More attention should be placed on assessments of mature Walleye fisheries using consistent methods.

The DFW has conducted few Walleye population assessments in a rivers and streams. Anecdotal information from other targeted species or general fisheries surveys is the primary source of information. Basic biology is unknown for Indiana's river and stream Walleye populations; however, these waterbodies have grown some of the largest Walleye observed in Indiana. The Record Fish Program has 34% of entries from rivers and the tied state record fish were both caught from rivers. Additionally, 20% of Record Fish entries were from Lake Michigan which is not monitored, but due to the vast complexity will be covered in a Lake Michigan plan.

Meeting stocking success criteria is only one portion of program success. The other component is angling use and harvest. Many Walleye angler creels were conducted within the first years of stocking and not all lakes have had follow-up surveys to ensure continued angling use. Some lakes that failed angling criteria are still stocked for a variety of reasons such as the minimal effort using fry, geographic distribution and small angling following. Angler creel methods strongly influence success metrics and the current protocols being employed are ineffective for monitoring Walleye anglers. Robust methods ensure sampling during peak Walleye fishing times (both seasonal and diel). In some instances seasonal coverage has been inadequate (winter harvest has largely been ignored in its entirety) and night fishing for Walleye is not measured. The use of voluntary creels from Walleye tournaments may prove useful to monitor the angling catch and satisfaction. The issues above highlight a need to review current methods and success criteria and refine where necessary to ensure adequate assessment of fishery performance.

[20] Kittaka, D. S. 2012. Statewide Percid plan for 2012 – 2016: Work plan F10D617. Indiana Department of Natural Resources, Division of Fish and Wildlife. Indianapolis, IN.

STRATEGIC PLAN

Population Goal: Supply quality Walleye populations statewide.

Objective: Maintain an annual broodstock collection that produce at least 23 million fry, 810,000 fingerlings, and 47,000 advanced fingerlings.

- **Problem:** Relying on a single broodstock source (Brookville Reservoir) poses risks with run timing, facility (spawning and rearing) limitations, potential disease, and genetic issues.
- **Strategies:**
    1. Develop a back-up broodstock source (potentially Monroe or Patoka Reservoirs), potentially a glacial lake, and use best management practices to address potential disease, growth and genetic issues.
    2. Develop and incorporate a broodstock collection, spawning and fish stocking plan to maintain genetic integrity.
    3. Determine if the genetic strain of Indiana Brookville Reservoir Walleyes is different to the commercially purchased fall advanced Walleye fingerlings in Northern Indiana.
- **Problem:** Hatchery infrastructure and labor is limited for the production of fall advanced fingerling Walleye.
- **Strategies:**
    4. Evaluate production process to improve efficiency and determine production trade-offs for all hatchery reared species to produce 47,000 fall advanced Walleye fingerlings.
    5. Monitor the cost-effectiveness of commercial purchases of advanced Walleye fingerlings, while matching genetic adaptations or strain with the waters most likely for success.
- **Problem:** Some Walleye lakes have natural reproduction, but the subsequent recruitment to the adult population is unknown.
- **Strategy:**
    6. Assess natural reproduction at locations where it is thought to make an important contribution to the fishery.

Objective: Refine Walleye program success criteria.

- **Problem:** Existing data have not been sufficiently inventoried, analyzed, or interpreted to identify data gaps or develop baseline indices.
- **Strategies:**
    7. Walleye Keeper of the Record will facilitate a critical review of current Walleye success criteria and propose refinements to the program.
    8. Evaluate northern Indiana lakes' response to the increase in the 2016 Walleye size limit.
- **Problem:** Current sampling protocols are outdated or non-existent.
- **Strategies:**
    9. Update and adopt a statewide sampling protocol that provide a mechanism to evaluate success criteria of juvenile and adult Walleye populations in lakes and reservoirs.

10. Adopt a statewide sampling protocol that provides a mechanism to evaluate success criteria of Walleye populations in rivers and streams.

- **Problem:** The most recent criteria to define the size and scope of the Walleye program was developed in 1987.
- **Strategies:**
    11. Create a structured Walleye stocking assessment process using metrics such as habitat characteristics, water quality, prey community, angler desires, and geographic location.
    12. Increase the size of the Walleye program to move towards supply-demand cool water stocked species target while maximizing added value.
    13. Walleye Keeper of the Record will facilitate a critical review of the current Walleye stocking strategies and propose refinements to the program.
- **Problem:** The current Walleye program is undersized and geographically clustered in certain areas.
- **Strategies:**
    14. Identify underserved and overserved areas using preference data from the 2017 LAS and relocate fisheries to suitable locations to meet angler needs.
    15. Consider saugeye stocking in lakes were Walleyes performed poorly to create a percid fishery closer to more anglers.

Human Dimensions Goal: Provide geographically distributed waters capable of attracting and sustaining Walleye angler interest.

Objective: Collect sufficient data needed to characterize angling preference, effort, catch, harvest and satisfaction.

- **Problem:** Lack of inexpensive and standardized creel survey methods to evaluate Walleye anglers.
- **Strategies:**
    16. Develop and conduct targeted, standardized, low-cost creel surveys at all stocked waters and rivers (e.g. tailwater fisheries).
    17. Walleye Keeper of the Record will maintain all targeted Walleye creel survey information and develop summary statistics every 5 years to guide program success and refinements.
    18. Partner with Walleye tournament organizers to collect monitoring data.
- **Problem:** Lack of information on Walleye anglers' interests and preferences limits the effectiveness of the program.
- **Strategies:**
    19. Utilize the Point-of-Sale system to identify Walleye anglers.
    20. Create a social survey for Walleye anglers (e.g., statewide angler survey) to measure effort, preference of catch (number versus size), stocking location/strategy, and management action support.

Objective: Maintain the current 23,000 Walleye anglers.

- **Problem:** Lack of program materials and information limit awareness of Walleye opportunities.
- **Strategies:**

21. Update DFW Walleye fishing webpage to include angling tactics, stocking lists, and pertinent research updates.
22. Utilize all approved Division communication methods to promote Indiana's Walleye fisheries.

Habitat Goal: Protect, restore and enhance habitat that provides anglers with fishable Walleye populations.

Objective: Maintain current water quality classifications at all Walleye lakes.[19]

- **Problem:** Various watershed management practices can lead to excessive nutrient, sediment, and contaminant runoff that damages water quality and threatens existing cool-water habitat.
- **Strategies:**
    23. Work with partners to promote best management practices through the Lake and River Enhancement Program, Soil and water conservation agencies, watershed groups, and other non-governmental organizations.
    24. Work with partners to ensure compliance with permit requirements to protect cool-water habitat.

Objective: Make efforts to enhance natural reproduction at all waters where it is occurring.

- **Problem:** The quality and amount of spawning habitat limits natural reproduction in waters where it is occurring.
- **Strategies:**
    25. In lakes that have natural reproduction, work with partners to enhance spawning habitats and provide protection for existing areas.2
    26. Investigate river spawning habitats and work with partners to improve those habitats that are identified.

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PRIORITIZED STRATEGIES

DFW staff were provided the opportunity to prioritize strategies using a voting system. Each staff member was provided a total of five (5) votes which could be distributed amongst multiple strategies or as few as one (1) strategy. The table below ranks strategies from highest priority to lowest priority based on the cumulative number of votes received by DFW staff. The percentage of votes each strategy received of all available votes is provided for reference.

Priority Rank	Strategy #	Strategy	Percent (%)
1	9	Update and adopt a statewide sampling protocol that provide a mechanism to evaluate success criteria of juvenile and adult Walleye populations in lakes and reservoirs.	19
2	7	Walleye Keeper of the Record will facilitate a critical review of current Walleye success criteria and propose refinements to the program.	11
3	6	Assess natural reproduction at locations where it is thought to make an important contribution to the fishery.	8
3	20	Create a social survey for Walleye anglers (e.g., statewide angler survey) to measure effort, preference of catch (number versus size), stocking location/strategy, and management action support.	8
5	1	Develop a back-up broodstock source (potentially Monroe or Patoka Reservoirs), potentially a glacial lake, and use best management practices to address potential disease, growth and genetic issues.	6
5	16	Develop and conduct targeted, standardized, low-cost creel surveys at all stocked waters and rivers (e.g. tailwater fisheries).	6
7	11	Create a structured Walleye stocking assessment process using metrics such as habitat characteristics, water quality, prey community, angler desires, and geographic location.	5
7	15	Consider Saugeye stocking in lakes were Walleyes performed poorly to create a percid fishery closer to more anglers.	5
9	2	Develop and incorporate a broodstock collection, spawning and fish stocking plan to maintain genetic integrity.	4
9	8	Evaluate northern Indiana lakes' response to the increase in the 2016 Walleye size limit.	4
9	10	Adopt a statewide sampling protocol that provides a mechanism to evaluate success criteria of Walleye populations in rivers and streams.	4

12	13	Walleye Keeper of the Record will facilitate a critical review of the current Walleye stocking strategies and propose refinements to the program.	3
12	14	Identify underserved and overserved areas using preference data from the 2017 LAS and relocate fisheries to suitable locations to meet angler needs.	3
12	22	Utilize all approved Division communication methods to promote Indiana's Walleye fisheries.	3
15	4	Evaluate production process to improve efficiency and determine production trade-offs for all hatchery reared species to produce 47,000 fall advanced Walleye fingerlings.	2
15	5	Monitor the cost-effectiveness of commercial purchases of advanced Walleye fingerlings, while matching genetic adaptations or strain with the waters most likely for success.	2
15	19	Utilize the Point-of-Sale system to identify Walleye anglers.	2
15	21	Update DFW Walleye fishing webpage to include angling tactics, stocking lists, and pertinent research updates.	2
15	25	In lakes that have natural reproduction, work with partners to enhance spawning habitats and provide protection for existing areas.	2
20	12	Increase the size of the Walleye program to move towards supply-demand cool water stocked species target while maximizing added value.	1
21	3	Determine if the genetic strain of Indiana Brookville Reservoir Walleyes is different to the commercially purchased fall advanced Walleye fingerlings in Northern Indiana.	0
21	17	Walleye Keeper of the Record will maintain all targeted Walleye creel survey information and develop summary statistics every 5 years to guide program success and refinements.	0
21	18	Partner with Walleye tournament organizers to collect monitoring data.	0
21	23	Work with partners to promote best management practices through the Lake and River Enhancement Program, Soil and water conservation agencies, watershed groups, and other non-governmental organizations.	0
21	24	Work with partners to ensure compliance with permit requirements to protect cool-water habitat.	0
21	26	Investigate river spawning habitats and work with partners to improve those habitats that are identified.	0

PROGRAM ACTIONS

2019

- Brookville Reservoir egg take operation was completed in 8 net nights collecting 2,459 male and 690 female Walleyes yeilding 38,151,999 eggs with a 77.5% hatch rate.

- Walleye stocking in 2019 was 26,440,450 fry, 598,431 fingerlings, and 4,125 advanced fingerlings. An additional 32,640 fall fingerling Walleye were purchased from a commerical fish supplier at a cost of $1.80/fish.

- Walleye fall stocking evaluation surveys were completed at the following lakes: Bass, Clear, Little Turkey, Maxinkuckee, and Shriner.

- A spring Walleye evaluation was completed at Lake Maxinkuckee.

- A Facebook theme week (7 posts 5/19 to 5/25) was completed on the DNR Facebook page reaching 91,465 138,564 impressions, and 6,397 engaged users. A DFW Facebook Posts on Oct 18 about fall stocking resulted in a reach of 40,699 and 5,809 engagements. A Wild Bulletin article on 10/3 titled “Walleye to be stocked in October.“ Walleye website had 7,692 unique page views.

SUMMARY REPORTS

APPENDIX A

Preference Calculation

The preference was calculated by using the top 3 fish species selected during 2016 Indiana Licensed Angler Survey (LAS).

% Preference = species LAS Top 3/total of all LAS top 3 %*100

% Walleye preference = 11.0 / 230.47*100 = 4.8%.

From 2011 National Survey of Fishing, Hunting, and Wildlife Recreation- Indiana:

Anglers (inland) - 745,290

Days of fishing (inland) - 20,719,290

Total expenditures (all waters) - $671,840,000

Total expenditures (inland): $665,138,060 ((427,310,000+244,530,000)-6,701,940)

Trip related (All waters) - $427,310,000

Equipment and other (All waters) - $244,530,000

Lake Michigan Expenditures: $6,701,940

Average total expenditures per angler day- $32.10 ($665,138,060/20,719,000 angler days). This figure includes all inland expenditures. (*Dollar value to be use for our creel analyses)

Economic value:

Total Fishing Trip Expenditures (Inland species) = $665,138,060

Species trip expenditures = % Species preference*$665,138,060 (total expenditures)

Walleye trip expenditures = 0.048*665,138,060=$31,926,626

APPENDIX B

Preference Calculation

See Appendix A.

From 2016 National Survey of Fishing, Hunting, and Wildlife Recreation- Indiana:
Anglers – 477,680

Economic Value:

Walleye licenses= Walleye preference*angler licenses
Walleye licenses=0.048*477,680=22,928

State-wide License value = $4.6M Sport Fish Restoration grant+$1.53M DFW matching funds = $6.13M
Individual license value=477,680 licensed anglers/$6.13M=$25.67
Indiana Walleye license revenue =22,928*25.67=$588,562

Because Division of Law Enforcement receives roughly half of license revenue:
Net Walleye license revenue=Indiana Walleye license revenue*0.5
Net Walleye license revenue=$588,562*0.5=$279,281