Technical Fisheries Session

Optimizing Saugeye Sampling Protocol[1]

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Abstract: Monthly electrofishing samples for saugeye (walleye x sauger hybrids; *Stizostedion vitreum* x *S. canadense*) were collected on 3 reservoirs during spring and fall, 1996. Sampling was stratified by day type (day and night) and habitat type (bass-cove and saugeye-main-lake shoreline and points). CPUE (*N* fish/hour) was calculated for 4 size classes and compared for each sampling stratum. Precision of the estimates was calculated and sampling recommendations made. Differences in seasonal catch rates were inconsistent among reservoirs and size classes. CPUEs of night samples were higher for size class A (≤ 310 mm; age 0) on all reservoirs. However, no clear diel pattern in catch rates of size classes B (311–400 mm; age 1), C (401–456 mm), or D (≥ 457 mm) was observed. Habitat type had little effect on CPUE and its associated precision. Precision of most samples was poor. A minimum of 10 hours of electrofishing would be needed to obtain estimates ±25% of the mean for most sampling strata tested. Sampling recommendations included collecting data on size class A using fall night electrofishing. However, reservoir-specific differences in catch rates and precision of the sampling strata tested would make statewide recommendations for appropriate sampling strategies of the larger size classes of saugeye suspect. It was recommended to change from a catch rate-based evaluation program to one based on size structure indices.

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With increasing demands placed on the time of fisheries management staff and shrinking budgets, increased sampling efficiency is imperative to maintain effective management programs. Further complicating the balance between available time and funds is the increased awareness that collecting statistically reliable data is needed to refine management strategies (Parrish et al. 1995). Habitat preferences of the target species, temporal changes in fish distribution patterns, and size selectivity of the sampling gear are, among other factors, contributors to bias associated with sampling protocols (Hayes 1983, Hubert 1983). These biases, in turn, influence the statistical reliability of the associated sample data. Minimizing, or at least accounting for, these biases are critical to development of effective sampling programs.

The Oklahoma Department of Wildlife Conservation (ODWC) has been stocking saugeye since 1985, and the fish has become an important part of Oklahoma's

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fisheries management program (saugeye were stocked in 18 and 29 reservoirs in 1996 and 1997, respectively). The ODWC has developed specific stocking criteria and objectives for the saugeye stocking program (Gilliland and Boxrucker 1995). Data on survival of stocked fingerlings through the first growing season are needed to assess stocking success. Saugeye are currently being stocked to reduce the abundance of slow-growing and/or stunted crappie (*Pomoxis* spp.) populations (Boxrucker 1992). However, saugeye do not become effective predators on crappie until reaching approximately 500 mm total length (TL) (Horton and Gilliland 1991). Current saugeye sampling procedures (night electrofishing and gill netting) do not adequately sample adult saugeye populations (ODWC, unpubl. data). As a result, it has not been possible to set realistic target catch rates of adult saugeye to provide effective control of overcrowded crappie populations. A statewide 457-mm minimum length limit is also in effect. Without adequate sampling techniques, it is difficult to reliably assess the effect the regulation is having on adult saugeye densities.

ODWC staff routinely collects spring daytime electrofishing samples for largemouth bass (*Micropterus salmoides*) in cove habitat. If the precision of the catch and size structure data on saugeye collected in these samples are adequate to make management recommendations, overall efficiency of sampling programs would be improved.

Sampling was conducted on 3 reservoirs: Holdenville Lake, Jean Neustadt lake, and Thunderbird Reservoir. These reservoirs were chosen for study largely based on past stocking history; saugeye have been stocked long enough for adult populations to develop. The objective of this study was to determine the differences in saugeye electrofishing catch rates and associated variability of the samples, for each of 4 size classes, by 1) season, 2) time of day, and 3) habitat type. Funding was received through the Federal Aid to Sport Fish Restoration, Grant F-50-R, Project 9.

Methods

Holdenville Lake is located in east-central Oklahoma and covers 223 ha. It was constructed in 1932 by the City of Holdenville as a water supply. The lake has a mean depth of 6 m and a maximum depth of 16 m, a shoreline development index (McMahon et al. 1996) of 3.3, and a secchi disk reading of 180 cm. Except for 1992, Saugeye have been stocked annually since 1988.

Jean Neustadt Lake, located in south-central Oklahoma, was impounded in 1968 and covers 187 ha. It has a mean depth of 3 m and a maximum depth of 14 m, a shoreline development index of 3.3, and a secchi disk reading of 76 cm. Except for 1992, saugeye have been stocked annually since 1989.

Thunderbird Reservoir was impounded in 1965 as the municipal water supply for several central-Oklahoma communities. It covers 2,448 ha and has a shoreline development index of 7.9, mean depth of 6 m, and maximum depth of 21 m. The reservoir is moderately turbid (mid-summer secchi disk readings average approximately 60 cm). Thunderbird Reservoir was first stocked with saugeye in 1985 and has received annual stockings since then.

Electrofishing Procedures

Boat-mounted electrofishing samples were collected on 2 dates on each reservoir during March, April, May, October, and November 1996. Samples were collected at fixed sites, with 2-person crews (1 dipper and 1 boat driver) using pulsed direct current (60 pulses/sec; 8–10 amperes). Electrofishing sites were stratified by habitat type as follows: 1) points and main-lake shoreline, hereafter referred to as saugeye habitat; and 2) coves, hereafter referred to as bass habitat. On each sample date, 6 15-minute electrofishing samples were collected during daylight hours in saugeye habitat, 6 15-minute electrofishing samples were collected during daylight hours in bass habitat, and 6 15-minute electrofishing samples were collected after dark in saugeye habitat. The day and night samples in saugeye habitat were collected at the same sites.

Saugeye were the only fish collected during sampling. All fish were measured to the nearest mm TL and weighed to the nearest g and divided into 1 of 4 size classes for analysis as follows: 1) ≤ 310 mm (age 0; designated as size class A); 2) 311–400 mm (age 1; designated as size class B); 3) 401–456 mm (designated as size class C); and 4) ≥ 457 mm (statewide minimum length limit; designated as size class D).

CPUE was expressed as number of fish/hour of electrofishing. Electrofishing CPUEs for each reservoir were compared by season (spring, Mar–May; fall, Oct–Nov), day type (day and night), and habitat type (bass and saugeye) for each size class. Residuals of the CPUE data were not normally distributed; therefore, the data were log transformed [$\log_e$ (CPUE+1)]. Differences in CPUE by season and day type and by season and habitat type were tested using a 2×2 analysis of variance (ANOVA). The interaction term was deleted in the comparisons with non-significant interaction terms in which both variables proved significant and P recalculated. P was determined using 1-way ANOVA for those comparisons with non-significant. Statistical significance was assessed at $P = 0.05$.

Sampling precision was measured by determining the CV of the $\bar{x}$ ($CV\bar{x} = SE\bar{x}^{-1}$; Cyr et al. 1992). A target level of precision was set at CV $\bar{x} = 0.125$. This value corresponds to $\pm 0.25\bar{x}$ and coincides with standards established for management studies by Robson and Regier (1964). Since $SE = SDN^{-2}$, rearranging the above equation, inserting the desired level of precision, and solving for N (number of samples) yields the equation:

$$N = 0.125^{-2}\bar{x}^{-2}SD^2. \quad (1)$$

Standard equations for estimating sampling size assume that the data are normally distributed and that the sample mean and variance are uncorrelated. I tested the mean-variance relationship for saugeye electrofishing data by using historical saugeye catch rate data from Thunderbird Reservoir (1993–1995) along with the data from Thunderbird Reservoir collected in this study. Only data from Thunderbird Reservoir were used to develop these relationships because insufficient samples were collected from Holdenville Lake and Jean Neustadt Lake to develop meaningful regression equations for data specific for those lakes. All size classes of saugeye were well represented in the Thunderbird Reservoir population which made data from this reservoir the best available choice for sample size calculations. Separate regression equations were developed for each size class for both day and night electrofishing samples (Table 1). Linear regression of $log_e SD^2$ on $log_e \bar{x}$ for saugeye ≤310 mm during the day, yielded the equation:

$$log_e SD^2 = 0.076 + 2.011 log_e \bar{x}. \quad (2)$$

The regression equation relating SD2 and $\bar{x}$ was back-transformed to a linear scale (exp) and corrected for transformation bias by adding the mean square error of the regression (MSE/2; Wilde 1993). The mean-variance relationship for all samples collected then becomes:

$$SD^2 = exp[(MSE/2) + 0.076 + 2.011\bar{x} \quad (3)$$

$$= exp[(0.109/2) + 0.076 + 2.011\bar{x}] \quad (4)$$

$$= 1.139\bar{x}^{1.22}. \quad (5)$$

These results were substituted into equation 1 and used to compute sample size requirements:

$$N = 1.139\bar{x}^{2.011}\bar{x}^{-2}0.125^{-2} \quad (6)$$

$$= 1.139\bar{x}^{0.011}0.125^{-2}. \quad (7)$$

The procedure was repeated for each size class and day type using the equations in Table 1. Regression equations from both day and night sampling were used in the calculation of sample size requirements for the respective day type comparisons. Regression equations from day sampling only were used in the habitat type comparisons.

Results

Seasonal and/or day type differences were evident in the electrofishing samples in saugeye habitat for most size classes (Table 2). However, only in 1 comparison (size class A from Holdenville Lake) did a significant interaction term exist. No seasonal difference was seen in CPUE of size class A from Jean Neustadt Lake and Thunderbird Reservoir (Table 2). However, differences by day type were evident (Table 2) with CPUE of night samples for size class A from all reservoirs being higher than those collected during the day (Table 3). Results of the paired comparisons for size class A from Holdenville Lake indicated that seasonal and day type differences existed (Table 2) with fall night samples having the highest CPUE (Table 3). Seasonal differences were seen for size classes B and C on all reservoirs (Table 2). However, these differences were not consistent among reservoirs; CPUE was higher in spring for size classes B and C at Holdenville Lake, higher in fall at Thunderbird Reservoir, and higher for size classes B and C in fall and spring, respectively, at Jean Neustadt Lake (Tables 2, 3). CPUE of size class B differed by day type for Holdenville Lake and Thunderbird Reservoir, but was not significant for Jean Neustadt

Table 1. Regression equations used to compute sample size requirements by size class. Individual equations were developed for each size class and day type. CPUE (*N*/hour) and variance (SD^2) estimates for each size class were derived from day and night electrofishing samples from Thunderbird Reservoir, Oklahoma , 1993–1996. MSE = mean square error of the regression (Wilde 1993). $N = 22$ day and 23 night.

	Day			Night		
Size class	Regression equation	R2	MSE	Regression equation	R2	MSE
A; ≤310 mm	$\log_e SD^2 = 0.076 + 2.011 (\log_3 CPUE)$	0.976	0.109	$\log_e SD^2 = 0.330 + 1.638(\log_e CPUE)$	0.948	0.149
B; 311–400 mm	$\log_e SD^2 = 0.382 + 1.749 (\log_e CPUE)$	0.943	0.161	$\log_e SD^2 = 0.246 + 1.541(\log_e CPUE)$	0.883	0.335
C; 401–456 mm	$\log_e SD^2 = 0.253 + 1.768 (\log_e CPUE)$	0.942	0.164	$\log_e SD^2 = 0.058 + 1.675(\log_e CPUE)$	0.798	0.552
D; ≥ 457 mm	$\log_e SD^2 = 0.438 + 1.726 (\log_e CPUE)$	0.827	0.281	$\log_e SD^2 = 0.743 + 1.267(\log_e CPUE)$	0.640	0.643
All sizes	$\log_e SD^2 = 1.068 + 1.495 (\log_e CPUE)$	0.861	0.280	$\log_e SD^2 = 0.348 + 1.154(\log_e CPUE)$	0.619	0.448

Table 2. Significance levels of 2 × 2 analysis of variance (ANOVA) by season (spring and fall) and day type (dan and night) for size classes of $\log_e$CPUE + 1 from electrofishing samples in saugeye habitat from 3 Okalahoma reservoirs, 1996.

	Holdenville Lake		Jean Neustadt Lake		Thunderbird Reservoir	
Size class	Season	Day type	Season	Day type	Season	Day type
A; ≤310 mm	0.0001[a]	0.0001[a]	0.077[c]	0.0001[c]	0.450[c]	0.0001[c]
B; 311–400 mm	0.004[b]	0.0001[b]	0.0001[c]	0.431[c]	0.0001[b]	0.028[b]
C; 401–456 mm	0.029[b]	0.038[b]	0.001[c]	0.179[c]	0.017[c]	0.119[c]
D; ≤457 mm	0.009[c]	0.448[c]	0.0001[c]	0.706[c]	0.0001[b]	0.0003[b]
All sizes	0.829[c]	0.0001[c]	0.893[c]	0.0001[c]	0.0001[c]	0.234[c]

[a]Significant interaction term; both variables significant.
[b]Interaction term not significant, both variables significant, *P* was calculated with 2 × 2 ANOVA with interaction term deleted from model.
[c]Interaction term not significant, ≤1 variable significant, *P* was calculated using 1-way ANOVA.

Lake (Table 2). Differences by day type for size class C were found at Holdenville Lake, but not for Jean Neustadt Lake or Thunderbird Reservoir (Table 2). CPUE of size classes B and C from Holdenville Lake were higher at night and CPUE of size class B was higher at night on Thunderbird Reservoir (Table 3). Seasonal differences in CPUE of size class D were seen at Holdenville Lake and Thunderbird Reservoir, but differences by day type were only observed for the Thunderbird Reservoir data (Table 2). Results of the paired comparisons for size class D from Jean Neustadt Lake indicated differences by season, but differences by day type within season did not exist (Table 2). The CPUE data, without regard to size class, showed differences by day type at Holdenville Lake and Jean Neustadt Lake and seasonal differences at Thunderbird Reservoir (Table 2).

Fewer differences were observed in the season and habitat type comparisons than in the season and day type comparisons. The interaction term was only significant for size class D at Thunderbird Reservoir and for size classes combined at Holdenville Lake (Table 4). No seasonal differences were observed for size class A and habitat type was significant only at Jean Neustadt Lake (Table 4). Differences were seen by season and habitat type for size class B from Holdenville Lake and Thunderbird Reservoir (Table 4). CPUE was highest in saugeye habitat in spring and fall at Holdenville Lake and Thunderbird Reservoir, respectively (Table 5). CPUE was higher in the fall for size class B at Jean Neustadt Lake, but differences by habitat type were not seen. No seasonal or habitat differences were observed for size class C from Holdenville Lake or Jean Neustadt Lake (Table 4). CPUE of size class C was higher in saugeye habitat from Thunderbird Reservoir, but no seasonal differences were found (Tables 4 and 5). Differences in CPUE for size class D were significant for both season and habitat type from Jean Neustadt Lake and Thunderbird Reservoir (Table 4). CPUE of size class D from Jean Neustadt was highest in spring in saugeye habitat and higher in fall in saugeye habitat at Thunderbird Reservoir (Tables 4, 5). Differences in CPUE by season and habitat type for size classes combined were seen for Holdenville Lake and Thunderbird Reservoir and by habitat type for Jean Neustadt Lake (Table 4). Spring sampling in saugeye habitat yielded the highest

Table 3. CPUE (*N*/hour) and CV $\bar{x}$ of saugeye from electrofishing samples, by season and size class, day and night, from 3 Oklahoma reservoirs, 1996. N = number of 15-minute samples to obtain a CV $\bar{x}$ = 0.125.

		A; ≤310 mm			B; 311–400 mm			C; 401–456 mm			D; ≥457 mm			All sizes		
Season	Daytime	CPUE	CV$\bar{x}$	*N*	CPUE	CV $\bar{x}$	*N*	CPUE	CV$\bar{x}$	*N*	COUE	CV$\bar{x}$	*N*	CPUE	CV$\bar{x}$	*N*
								Holdenville Lake								
Spring	Day	0.44	358.6	72	4.56	151.6	69	1.89	171.6	77	1.44	177.0	103	8.33	123.8	73
	Night	5.67	134.3	51	8.22	95.2	37	3.00	125.0	63	1.67	133.0	128	18.50	64.8	27
Fall	Day	0.00			0.50	270.3	121	0.50	270.3	105	0.50	270.3	138	1.50	205.3	175
	Night	31.67	531	27	5.67	115.2	49	2.17	237.2	70	0.83	315.8	212	39.17	58.0	19
								Jean Neustadt Lake								
Spring	Day	0.89	265.9	73	0.11	600.0	177	0.89	218.1	92	5.89	137.3	70	7.78	121.7	76
	Night	19.33	141.0	33	0.56	252.5	127	2.22	225.4	69	8.56	128.0	38	30.67	90.0	21
Fall	Day	3.00	163.3	74	3.67	173.0	73	0.00			2.50	235.0	89	9.17	113.3	70
	Night	19.17	84.8	33	2.50	131.9	64	2.22	489.9	160	0.00			21.83	83.3	25
								Thunderbird Reservoir								
Spring	Day	8.33	221.7	75	3.89	138.0	72	6.56	114.1	58	8.89	94.5	63	27.67	95.3	40
	Night	18.82	86.5	33	5.41	114.9	45	6.82	165.5	48	7.88	130.1	41	38.94	78.0	19
Fall	Day	3.50	194.5	74	15.17	113.2	51	12.33	91.7	50	27.50	81.2	46	58.50	65.2	27
	Night	17.83	128.4	34	22.00	60.2	23	6.00	94.3	50	8.67	57.2	38	54.50	51.7	16

Table 4. Significance levels of 2 × 2 analysis of variance (ANOVA) by season (spring and fall) and habitat type (bass and saugeye) for size classes of $\log_e$CPUE + 1 from day electrofishing samples from 3 Oklahoma reservoirs, 1996.

	Holdenville Lake		Jean Neustadt Lake		Thunderbird Reservoir	
Size class	Season	Habitat	Season	Habitat	Season	Habitat
A; ≤310 mm	0.665[c]	0.887[c]	0.080[c]	0.018[c]	0.590[c]	0.801[c]
B; 311–400 mm	0.001[b]	0.001[b]	0.001[c]	0.117[c]	0.0001[b]	0.049[b]
C; 401–456 mm	0.251[c]	0.085[c]	0.272[c]	0.257[c]	0.139[c]	0.049[c]
D; ≥457 mm	0.140[c]	0.486[c]	0.013[b]	0.030[b]	0.007[a]	0.0004[a]
All sizes	0.011[a]	0.023[a]	0.757[c]	0.001[c]	0.010[b]	0.006[b]

[a]Significant interaction term; both variables significant.
[b]Interaction term not significant, both variables significant, P was calculated with 2 × 2 ANOVA with interaction term deleted from model.
[c]Interaction term not significant, ≤1 variable significant, P was calculated using 1-way ANOVA.

CPUE among the respective sampling strata at Holdenville Lake for all size classes combined, while fall samples in saugeye habitat had the higher CPUEs from Thunderbird Reservoir (Tables 4, 5). No seasonal differences were found in the Jean Neustadt Lake samples when all size classes were combined, but samples collected in saugeye habitat yielded higher CPUEs.

Precision ($CV\bar{x}$) of most samples was poor (Tables 3, 5). Precision of the night samples was generally better than that for the day samples (Table 3). However, stratifying the day samples by habitat type did little to improve precision (Table 5). Stratifying the CPUE data by size class increased the sample size requirement to obtain a $CV\bar{x} = 0.125$ to >60 samples for most size classes, day types, and habitats (Tables 3 and 5). The precision of the Thunderbird Reservoir samples was generally better than the respective samples from the other 2 reservoirs sampled (Tables 3, 5). By combining size classes, the target level of precision could be reached in 4–6 hours of electrofishing at night in saugeye habitat (Table 3).

Discussion

Night electrofishing for age-0 (size class A) saugeye clearly provided higher catch rates and increased precision over sampling during the day for each reservoir tested. This is consistent with sampling recommendations for collecting age-0 and yearling walleye (McWilliams and Larscheid 1992, Serns 1982). However, seasonal, diel, and habitat considerations were not as consistent among lakes for the larger size classes (≥ age 1). The precision and catch rates of age-1 saugeye (size class B) were higher at night during the fall on 2 reservoirs (Jean Neustadt Lake and Thunderbird Reservoir). Spring night sampling of age-1 saugeye at Holdenville Reservoir provided higher catch rates and precision than the respective fall samples. Daytime electrofishing samples indicated that age-1 saugeye generally showed a preference for saugeye habitat. Seasonal differences in catch rates were observed for size classes C and D, but these were not consistent among reservoirs. Day type and habitat considerations did not appear critical for sampling size class C, with differences detected

Table 5. CPUE (N /hour) and CV $\bar{x}$ of saugeye from electrofishing samples by season and size class (A-D) from largemouth bass habitat (coves) and saugeye habitat (points and main-lake shoreline) from 3 Oklahoma reservoirs, 1996. N = number of 15-minute samples to obtain a CV $\bar{x}$ = 0.125.

		A; ≤310 mm			B; 311–400 mm			C; 401–456 mm			D; ≥457 mm			All sizes		
Season	Habitat	CPUE	CV$\bar{x}$	N	CPUE	CV $\bar{x}$	N	CPUE	CV$\bar{x}$	N	CPUE	CV$\bar{x}$	N	CPUE	CV$\bar{x}$	N
								Holdenville Lake								
Spring	Bass	0.11	600.0	71	0.67	268.3	113	0.44	286.9	108	1.11	252.5	111	2.33	123.8	140
	Saugeye	0.44	358.6	72	4.56	151.6	69	1.89	171.6	77	1.44	177.0	103	8.33	64.8	73
Fall	Bass	0.33	338.8	72	0.00			0.67	228.4	98	0.67	288.9	128	1.67	205.3	166
	Saugeye	0.00			0.50	270.3	121	0.50	270.3	105	0.50	270.3	138	1.50	58.0	175
								Jean Neustadt Lake								
Spring	Bass	0.56	350.7	72	0.22	418.2	148	0.11	600.0	149	2.78	178.3	86	3.67	157.3	111
	Saugeye	0.89	265.9	73	0.11	600.0	177	0.89	218.1	92	5.89	137.3	70	7.78	121.7	76
Fall	Bass	0.50	358.7	72	0.83	244.3	106	0.67	382.2	98	0.83	399.8	120	2.83	179.0	127
	Saugeye	3.00	16.3	74	3.67	173.0	73	0.00			2.50	235.0	89	9.17	113.3	70
								Thunderbird Reservoir								
Spring	Bass	8.56	234.7	75	3.56	207.9	74	7.00	86.3	57	10.00	126.7	61	29.11	128.8	39
	Saugeye	8.33	221.7	75	3.89	138.0	72	6.56	55.9	58	8.89	94.5	63	27.67	95.3	40
Fall	Bass	4.33	156.2	74	8.00	150.4	60	4.67	26.0	63	7.17	95.9	67	24.17	87.8	43
	Saugeye	3.50	194.5	74	15.17	113.2	51	12.33	127.9	50	27.50	81.2	46	58.50	65.2	27

only for day type at Holdenville Lake and habitat type at Thunderbird Reservoir. Precision of the night samples of size class from Thunderbird Reservoir were higher than that for day samples; however, catch rates were highest during the day in fall. Sampling size class D in saugeye habitat generally increased catch rates and precision of the estimates from Jean Neustadt Lake and Thunderbird Reservoir. The data from Holdenville Lake and Jean Neustadt Lake are similar to the findings of Johnson et al. (1988) who reported higher catch rates of ≥ age-1 saugeye from night electrofishing samples in spring than in fall from Pleasant Hill Reservoir, Ohio. However, the Thunderbird Reservoir data indicated that daytime sampling in the fall provided higher catch rates of adult saugeye although precision was improved during night sampling.

The low level of precision of the electrofishing samples is cause for concern and indicates the need to modify existing sampling strategies. Increasing the amount of effort needed to meet the aforementioned precision standards is unrealistic. Lowering the target level of precision ($CV\bar{x} = 0.25$), selecting alternate population characteristics on which to base management decisions, and/or assessing alternate sampling gears may need to be considered before an effective saugeye management program is established.

Reducing the amount of time in a unit of effort (i.e., from 15 minutes to 10 minutes) would increase the number of samples collected over a given amount of sampling effort. However, this may not improve the precision of the samples. Precision of estimates can be affected by both the number of samples and the size of the individual samples (Gulland 1966). By decreasing the size of the individual estimates, sampling precision may actually be decreased. Accepting a lower level of precision in the electrofishing data ($CV\bar{x} = 0.25$; $\pm 50\%\bar{x}$) would reduce the sample size requirements by a factor of 4. This would bring the effort required down to approximately 4 hours (1–2 days of effort per reservoir). The drawback to lowering the acceptable level of precision would be that a 50% change in population abundance or size structure would be needed before statistical differences in the data could be detected. It may be unreasonable to expect such large changes in structure to be brought about by management strategies such as changes in stocking protocols and/or length limits.

The ODWC currently evaluates population structure using CPUE by species-specific size categories (ODWC, unpubl. data). Evaluating saugeye populations in this manner may not be appropriate due to the poor precision of the estimates. Precision of estimates from electrofishing samples in this study was improved markedly when size classes were combined (Tables 3, 5). CPUE data may be appropriate when evaluating overall population abundance, but not size structure. A size structure index (such as PSD and RSD; Gabelhouse 1984) may be more effective for making management recommendations.

Based on past sampling, it appears unlikely that using gill nets to sample saugeye would be an acceptable alternative. Age-0 saugeye are typically not fully recruited to the sampling gear (ODWC, unpubl. data). The average number of saugeye collected in a typical gill-net sample was 20 and 45 for the 8 and 10 reservoirs sampled in 1996 and 1997, respectively (ODWC, unpubl. data). Such small samples would not even be appropriate for developing length-frequency distributions.

The results of this study indicated that differences in size-specific catch rates by season, day type, and habitat type were evident among the reservoirs sampled. This may make the development of statewide sampling protocols suspect. At the very least, biologists need to critically analyze the data being collected and consider adjusting existing sampling strategies if the statistical reliability of the data comes into question.

Recommendations

1. Fall night electrofishing samples should be used to evaluate abundance of age-0 and yearling saugeye. However, effort needs to be increased substantially (7–8 hours/reservoir) to provide estimates of sufficient reliability on which to base management decisions.
2. Seasonal, day type, and habitat type differences were found in catch rates of size classes C and D among the reservoirs tested. Therefore, it would be inappropriate to combine data from samples collected using various sampling protocols, i.e., combining data using methods specifically designed for collecting saugeye with those using methods targeting largemouth bass should not be considered.
3. Consideration should be given to modifying existing saugeye population evaluation parameters with attention given to size structure indices, such as the length categorization system proposed by Gabelhouse (1984).

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