An Evaluation of Angler Harvest of Walleye and Saugeye in a Kansas Reservoir

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ABSTRACT

The saugeye (walleye [*Sander vitreus*] × sauger [*S. canadensis*]) has been stocked across the midwestern United States to provide large-bodied percid fisheries in systems that are unsuitable for walleye or sauger. Although the saugeye often exhibits faster growth than sauger and better stocking survival than walleye in warm, turbid reservoirs, a common justification for stocking saugeye is the belief that it is more vulnerable to angling than the walleye, particularly during summer. Direct comparisons of walleye and saugeye harvest have not been conducted; therefore, patterns of walleye and saugeye harvest were evaluated in Glen Elder Reservoir, Kansas. We tagged 1,438 walleyes and 289 saugeyes with Carlin dangler tags during 2001-2003. The percentage of tags returned was nearly identical between taxa; 44.6% of the tagged walleyes and 46.0% of the tagged saugeyes were harvested. Similarly, 81.1% of the walleyes and 81.6% of the saugeyes were harvested during April-June. Few fish were harvested during summer. Approximately 90% of both walleyes and saugeyes were harvested within 15 months of tagging. Results of the study suggest that harvest rates and temporal harvest patterns do not differ between walleye and saugeye.

INTRODUCTION

Stocking fish has long been used by fisheries managers to manipulate fish populations (Heidinger 1999). In recent years, stocking hybrid sport fishes has become increasingly popular (Neal et al. 1999, Rumsey et al. 2007), largely because they often exhibit higher survival and faster growth than parental species and because they help to diversify fisheries (e.g., Rohrer and Thorgaard 1986, Storck and Newman 1992, Olson et al. 2007). Moreover, many hybrids are sterile, which allows managers to closely regulate population densities. One hybrid that has gained popularity across the midwestern U.S. is the saugeye (walleye [*Sander vitreus*] × sauger [*S. canadensis*]).

The walleye continues to be one of the most popular sport fishes in North America (Carlander 1997), and managers are often tasked with managing walleye populations in systems that are inadequate for natural reproduction and recruitment. Although walleye is commonly stocked in systems that lack natural recruitment, stocking is often ineffective for sustaining a fishery (Ellison and Franzin 1992, Carlander 1997). Managing walleye in turbid reservoir systems with high water temperatures and low water retention times is particularly problematic (Momot et al. 1977, Quist et al. 2002, 2003a). When the habitat is not suitable for walleye, one option for establishing a percid fishery is to stock sauger. However, sauger stockings are rarely successful and may result in low angler satisfaction due to the small size of sauger relative to walleye (e.g., Erickson 1980). The saugeye is typically more tolerant of warm, eutrophic conditions than walleye and has a faster growth rate than sauger (Lynch et al. 1982, Humphreys et al. 1987, Malison et al. 1990). Consequently, the saugeye is often stocked into reservoirs

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that are marginal or unsuitable habitat for walleye (Leeds and Summers 1987, Flammang and Willis 1994). Regardless of whether it exhibits higher stocking survival than walleye or faster growth than sauger, a common argument of those supportive of continued saugeye stocking is that it is more "aggressive" and more likely to be harvested by anglers than the walleye. In addition, walleye fisheries in many systems of the southern Great Plains tend to exhibit poor catch rates during summer when water temperature and prey densities are high. As such, another common argument provided in support of saugeye stocking is the belief that it is more likely to be harvested during summer than walleye. In Kansas, the saugeye has been stocked into about 63 large reservoirs and small impoundments to provide a *Sander* fishery where walleye or sauger fisheries have failed (J. Goeckler, unpublished information). Since direct comparisons of walleye and saugeye harvest are absent from the literature, this study was conducted to examine the difference in angler harvest of walleye and saugeye in Glen Elder Reservoir, Kansas.

MATERIALS AND METHODS

Glen Elder Reservoir is a large (i.e., 5,093 ha) impoundment in western Kansas. The reservoir is relatively shallow (mean depth = 5.8 m), has moderate turbidity, and does not thermally stratify due to persistent high winds (Quist et al. 2002). Construction of the dam was completed in 1969, and walleyes were stocked soon thereafter. Results of extensive research on the walleye population in Glen Elder Reservoir have shown that the walleye exhibits fast growth, variable recruitment (natural and stocked contributions), and high mortality (Quist et al. 2003a, 2003b, and 2004). Larval walleyes are stocked annually to supplement natural recruitment, and in 1998 larval saugeyes were accidently stocked in the reservoir. Many saugeyes survived and began contributing to the percid

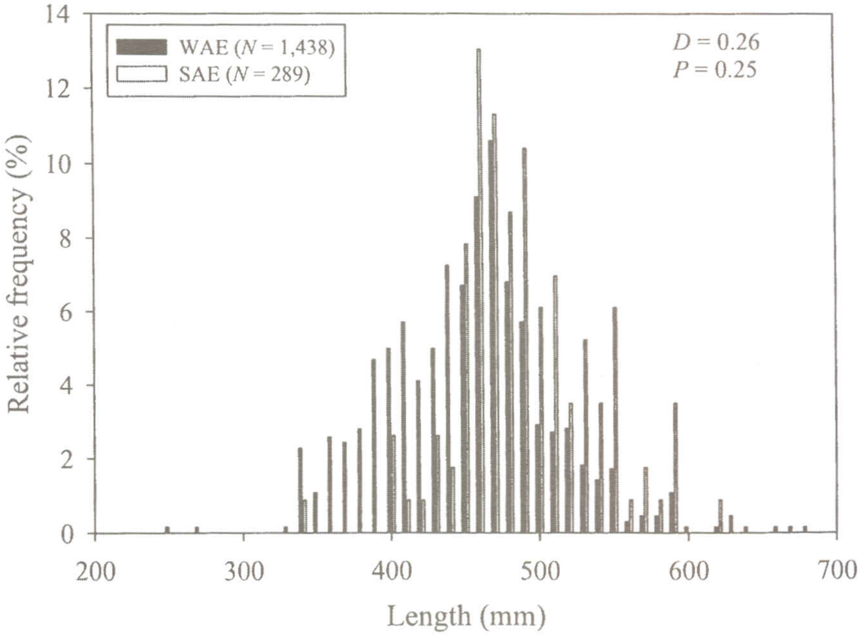

Figure 1. Length-frequency distributions of walleyes (WAE) and saugeyes (SAE) tagged in Glen Elder Reservoir, Kansas, 2001-2003. The D-statistic is the test statistic for a Kolmogorov-Smirnov test that examined whether the two length-frequency distributions were significantly different. The numbers in parentheses are the numbers of tagged fishes.

fishery. In response to concerns of overfishing of the walleye fishery, a tagging study was initiated in 2000 to provide insight on exploitation of walleye. The presence of both saugeye and walleye in Glen Elder Reservoir provided an excellent opportunity to evaluate differences in harvest between the taxa.

Fishes were tagged during fall (i.e., October-November) and spring (i.e., March-April) in one of three tagging seasons: 2000-2001 (i.e., October-November 2000, March-April 2001), 2001-2002, and 2002-2003. Saugeyes were not tagged during the 2000-2001 tagging season; therefore, only data from the 2001-2002 and 2002-2003 seasons were used in this study. Nighttime boat electrofishing was used to sample fishes. All fishes were measured to the nearest millimeter (total length) and weighed to the nearest gram.

Fish were tagged with Carlin dangler tags (Floy Tag and Mfg., Inc., Seattle, Washington). A unique identification number and "$ REWARD $" was printed on one side of the tag. The opposite side of the tag was printed with "KDWP, Box 1525, Emporia, KS 66801." Media (i.e., radio and newspaper) and signage at local businesses, park entrances, and boat ramps informed anglers of the study. The amount of the reward was randomly assigned to each tag ($5, $20, or $100). Anglers were unaware of the reward amount until they returned the tag and received the reward in the mail. Anglers that caught a tagged fish provided information on the date and location of where the fish was caught and whether or not the fish was harvested.

The length distribution of walleye and saugeye at tagging was compared using a Kolmogorov-Smirnov test (Sokal and Rohlf 1995). A difference in the percentage of tags returned for walleye and saugeye was examined using a chi-square test. The proportion of fish harvested in each month and time-at-large was summarized to provide insight on temporal differences in harvest. All analyses were conducted using SAS (SAS 1996) and $\alpha = 0.05$.

RESULTS

Tagged walleyes ($N = 1{,}438$) varied in length from 257 mm to 687 mm (mean ± SD; 454.3 ± 46.1 mm), and saugeyes ($N = 289$) varied from 343 mm to 623 mm (494.2 ± 46.1 mm; Fig. 1). Although saugeyes tended to be slightly larger than walleyes, the length distribution of tagged fish was not significantly different between walleyes and saugeyes ($P = 0.25$). Therefore, any differences in harvest were not likely due to the length of tagged fish. The proportion of tags returned was similar for walleyes (642 tags or 44.6% returned) and saugeyes (133 tags or 46.0% returned; $\chi^2 = 0.15$, $P = 0.70$). Temporal patterns in harvest of tagged fish were also similar between walleyes and saugeyes. Nearly all walleyes (81.1%) and saugeyes (81.6%) were harvested during April-June, and few fish were harvested during fall and winter (Fig. 2). Harvest during summer was typically low and was similar between walleye and saugeye. Approximately 90% of the walleyes and saugeyes were harvested within 15 months of tagging.

DISCUSSION

A limited number of studies have examined harvest of hybrids relative to parental species. Axon and Whitehurst (1985) surveyed 48 state natural resource management agencies for information on striped bass (*Morone saxatilis*) and wiper (striped bass × white bass [*M. chrysops*]) fisheries. Using information from about 400 lakes and reservoirs and 20 river systems, the authors found that total yield of *Morone* spp. was highest in systems with both striped bass and wipers (mean yield = 3.0 kg/ha), followed by systems with only striped bass (1.1 kg/ha) or only wipers (0.7 kg/ha). Wahl and Stein (1993) evaluated growth, survival, and harvest of muskellunge [*Esox masquinongy*], northern pike [*E. lucius*], and tiger muskellunge (muskellunge × northern pike) in three Ohio reservoirs. A creel survey indicated that angler catch rates were highest for northern pike and lowest for tiger muskellunge. Although several studies have estimated stocking survival and growth of walleye and saugeye, we are aware of only one study that has evaluated differences in harvest between these taxa. Johnson et al. (1988) evaluated population characteristics of walleye and saugeye in Pleasant Hill Reservoir, Ohio and found that growth, survival, habitat use, and food habits were nearly identical. The study lacked estimates of exploitation due to the design of the creel survey; however, the authors argued that vulnerability to angling was similar between walleye and saugeye, a conclusion based on similarities in the ratio of fish observed in the creel and the ratio of fish in standardized population samples. Our study provides a direct comparison of walleye and saugeye harvest and supports the conclusions of Johnson et al. (1988) that vulnerability of saugeye to recreational harvest is the same as for walleye. Although saugeye may diversify fisheries and provide an alternative to walleye in systems where walleye has poor growth or survival, concerns associated with the genetic integrity of parental species must be considered.

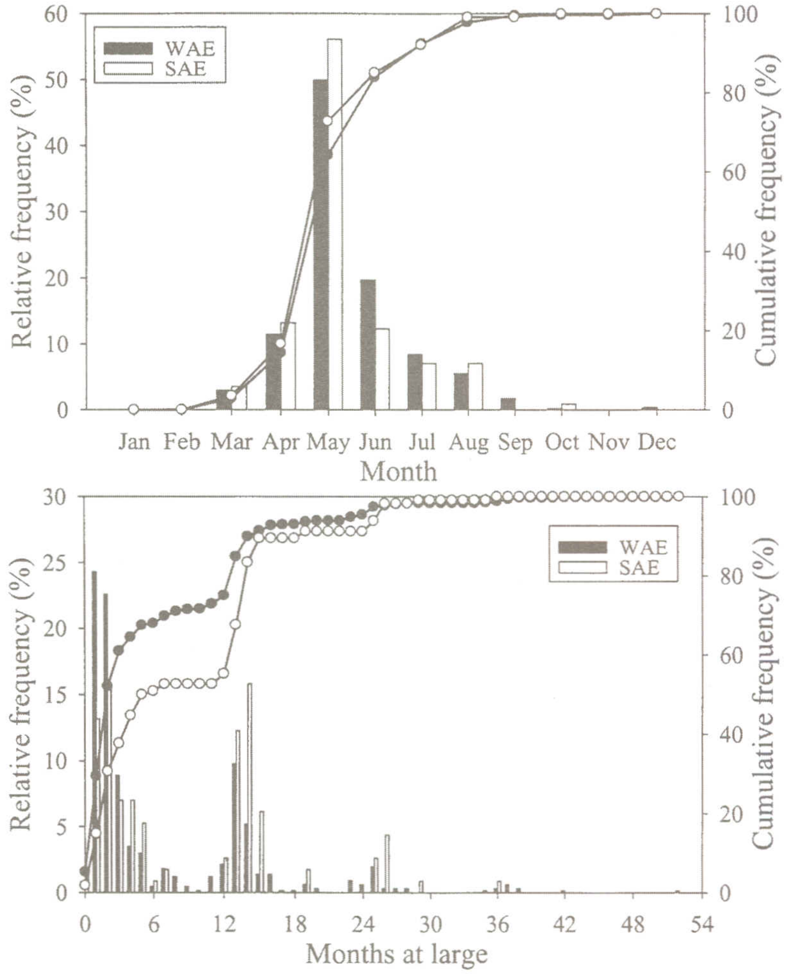

Figure 2. Months when tagged walleyes (WAE) and saugeyes (SAE) were harvested (upper panel) and months at large (i.e., number of months between tagging and harvest) of harvested fishes (lower panel) from Glen Elder Reservoir, Kansas. Bars represent relative frequencies, and lines represent cumulative relative frequencies.

Hybridization is a major concern among aquatic ecologists. Perry et al. (2002) provide a thorough discussion and review of hybridization in freshwater systems and suggested that hybridization is one of the most important factors associated with the poor status of aquatic organisms. For example, hybridization of cutthroat trout (*Oncorhynchus clarki*) with rainbow trout (*O. mykiss*) is a primary threat to the persistence of cutthroat trout (Weigel et al. 2003). Similar concerns have been expressed for a variety of aquatic and terrestrial organisms (Rhymer and Simberloff 1996, Allendorf et al. 2001, Perry et al. 2002). Although hybridization of walleye and sauger occurs rarely in nature (Stroud 1948, Van Zee et al. 1996), widespread stocking of artificially-produced hybrids is cause for concern. Saugeyes have been shown to successfully spawn with themselves and to backcross with parental species (Hearn 1986). Fiss et al. (1997) evaluated the genetic structure of *Sander* spp. in Normandy Reservoir, Tennessee. Of the 35 fish examined, 24 were backcrossed or F_2 individuals, nine were walleyes, one was an F_1 hybrid, and one was an F_2 hybrid. The author concluded that the artificial introduction of saugeye to the system not only precluded control of *Sander* population densities by managers, but also compromised the genetic integrity of walleye in the reservoir and placed downstream stocks of walleye and sauger at risk. The walleye is a nonnative species in Kansas (Cross and Collins 1995) and although managers are concerned about the genetic integrity of the walleye, the primary concern with widespread stocking of saugeye is its potential influence on downstream sauger populations. Sauger is one of the most widely distributed species in North America and is native to rivers and streams in Kansas (Lee et al. 1980, Cross and Collins 1995, Carlander 1997). Despite its widespread occurrence, it is a species of high conservation concern in many portions of its distribution (Baxter and Stone 1995, McMahon and Gardner 2001) and any action that threatens the integrity of the species should be well justified. The Kansas Department of Wildlife and Parks is cognizant of concerns regarding the genetic integrity of sauger. As such, it has recently been investigating the use of triploid saugeye to minimize its ability to reproduce.

Several studies have suggested that stocked saugeyes have higher survival and recruitment to the fishery than walleye (Lynch et al. 1982, Flammang and Willis 1994; but also see Johnson et al. 1988). Controlled investigations of differential stocking success between walleye and saugeye have not been conducted in Kansas, but some evidence suggests that the saugeye provides a fishery in small impoundments (i.e., < 65 ha) where walleye recruitment is limited (Mosher 2001). While the saugeye may recruit better than walleye in some systems, the belief that the saugeye is more readily harvested was not supported by our data. Given these results and concerns associated with the conservation of walleye and sauger, the benefits of stocking saugeye in a system should be carefully weighed against the risks of compromising the genetic integrity of parental species.

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