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A Review of Walleye Stocking Evaluations and Factors Influencing Stocking Success

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Abstract

We reviewed the primary literature and agency reports from Wisconsin, Minnesota, Michigan, and Canadian provinces on walleye *(Stizostedion vitreum)* stocking evaluations. Although a considerable body of grey literature is available, it did not add substantially to this review because of study design flaws and a lack of clear and objectively defined criteria for assessing project success. Peer-reviewed literature contained several case histories that did not lead to generalized conclusions. A comprehensive review of case histories in North America and an analysis of an extensive set of case histories in Minnesota led Laarman (1978) and Li et al. (1996a) to the conclusion that supplemental stocking to enhance existing populations was usually not successful. Based on a limited number of studies, size of fingerling stocked influenced survival; large fingerling (>5 inches) provided the highest returns. However, the higher survival of large fingerling does not appear to offset the increased production costs. Walleye body condition appears to be important to survival once stocked. Genetic differentiation exists among walleye populations. Genetically appropriate stocks should be used for introductory and maintenance stocking to increase the probability of success, and when supplemental stocking is required, broodstock should come from the same system to minimize genetic risk. Some important abiotic factors related to success of introductory stocking have been identified, but little information is available regarding abiotic factors related to successful maintenance stocking programs.

Contents

Introduction, 1
Discussion, 1
Culture and Distribution, 1
Size at Stocking, 2
Stocking Density, 3
Predators and Cannibalism, 3
Forage, 3
Genetic Issues in Walleye Stocking, 3
Within-population Variation, 4
Among-population Variation, 4
Abiotic Characteristics, 4
Cost/Benefit, 5
Sociological Factors in Walleye Stocking, 6
Summary and Recommendations, 6
Addendum, 8
Literature Cited, 9

Introduction

Walleye *(Stizostedion vitreum)* stocking has been a component of fish management programs in the United States and Canada for over a century (Laarman 1978). Evaluations of this practice began 60 years ago (Hile 1937). Since that time, biologists have evaluated the contribution of stocked fish to specific year classes or general population abundance, estimated survival of stocked fish to several sizes or ages, and compared the relative contribution of fish stocked of various sizes and from different culturing techniques. Factors potentially related to survival, including predation, food supply, basin characteristics, and population genetics, have also been studied. Monetary costs and benefits of walleye stocking have been addressed more recently.

Although hundreds of agency reports and published studies have dealt with propagation and stocking of walleye (Ebbers et al. 1988), relatively few of these studies provided definitive directions for stocking programs. Many studies suffered from design problems including small sample sizes, lack of replication, confounding variables, or lack of controls. Many are individual case histories that are not easily generalized to new situations. Others lack clear and objectively defined criteria for assessing success or failure. In this review, we attempt to summarize and review the existing information, concentrating on the peer-reviewed literature. We conclude with direct management recommendations supported by the literature, identify information gaps, and suggest areas for further study.

Laarman (1978) provided an extensive review of walleye stocking case histories. He summarized findings in three categories; introductory, maintenance, and supplemental plants. Introductory plants into new impoundments and natural lakes without walleye were successful in 48% of the cases. More recently, examples of reintroductory successes have been documented for walleye (Green 1986, Jude 1992) and sauger *(Stizostedion canadense)* (Rawson and Scholl 1978). Bennett and McArthur (1990) analyzed variables related to introductory successes and developed a model that correctly predicted introductory successes with 70% accuracy. Their definition of success was limited to the establishment of a self-sustaining walleye population. Additional considerations that could be used to evaluate the overall success of introductory stocking include impacts to native fish communities (Courtney, Jr. 1993). Laarman's (1978) second category of maintenance stockings, defined as periodic stocking to maintain a fishery with no natural reproduction, was considered successful 32% of the time. The final category of supplemental stocking was defined as stocking to supplement natural year classes of walleye. These efforts were successful in 5% of the reviewed case histories. Li et al. (1996a) analyzed an extensive data set on stocking results for Minnesota lakes and also concluded that supplemental stocking did not increase walleye abundance. Furthermore, when supplemental stocking did contribute to a year class, the adjacent year classes were generally depressed (Li et al. 1996b). Observations of suppression of year classes after strong year classes are not uncommon (Chevalier 1973, Beyerle 1978, Schneider 1979, Parsons et al. 1994).

Many factors have been associated with the success or failure of walleye stocking. These include condition at the time of stocking (which sums the effects of culture technique, time and method of harvest, and distribution); stocking density; predation; food supply of stocked waters; genetic characteristics of stocked fish; and receiving basin abiotic characteristics.

Discussion

Culture and Distribution

McWilliams and Larscheid (1992) and Mitzner (1992) observed conflicting results for survival of intensively reared, pellet-fed walleye versus extensively reared fingerling raised in nursery ponds with natural food. The authors noted their results may have been confounded by differences in observed condition of stocked fish from various sources. McWilliams and Larscheid (1992) observed that the condition of pellet-fed fish was poor because of stresses in the hatchery, and subsequent survival was poorer than extensively reared fish. Conversely, Mitzner (1992) reported higher survival of pellet-fed fish versus extensively reared walleye but noted that visual observations of the condition of extensively reared walleye was poor. They suspected the poor condition of extensively reared fish was partly related to transport time, which was 6 hours compared to 20 min for McWilliams and Larscheid (1992). Pitman and Gutreuter (1993) found transport time was significantly related to 24-hour mortality of fry stocked in Texas reservoirs.

Direct measures of fish condition and subsequent survival are uncommon in the literature, but condition of stocked fish may be a confounding factor in many studies comparing culture techniques or assessing year to year variation in survival of stocked fish. Bandow and Anderson (1993) found overwinter survival of fingerling from 120 mm to 187 mm was influenced by body condition at the time of stocking.

Size at Stocking

Several studies have documented survival of walleye stocked as fingerlings (Mraz 1968; Laarman 1981; Hauber 1983; Schneider 1983; Green 1986; Johnson et al. 1988; Santucci, Jr. and Wahl 1993), but few exist for fry (Mathias et al. 1992, Pitman and Gutreuter 1993). Survival estimates for fingerling have most commonly been to the first (as young-of-the-year, YOY) or second fall (as age I+ fish) after stocking (Table 1). Results were quite variable but suggest that large fingerling generally have higher survival rates than small or medium fingerling.

Additional studies that contain estimates of relative contribution to year classes of various sizes of stocked walleye showed no clear advantage of stocking large fish. Jennings and Philipp (1992) observed variable results for three size classes of walleye stocked in small impoundments. Results varied among four lakes stocked within each year and from year to year within lakes. Koppelman et al. (1992) observed that small fingerling had higher relative survival than large fingerling in two Missouri impoundments stocked during a single year. Production of large fingerling (>5 inches) is relatively new. Additional evaluations of this approach are anticipated.

Table 1. *Percent survival to the first fall (as YOY) or second fall (as age I+) of walleye stocked at various sizes.*

	Percent Survival					
	First Fall			Second Fall		
Author	Small <50 mm	Medium 75-125 mm	Large >150 mm	Small <50 mm	Medium 75-125 mm	Large >150 mm
Mraz 1968		0.0				
Laarman 1981						0.0
						0.0
						21.0
						25.0
						27.0
						30.0
Hauber 1983		4.0			2.2	
					3.4	
Schneider 1983						55.0
						70.0
						8.0
						6.0
						7.0
						4.0
Green 1986					14.2	
					0.0	
					5.0	
					31.4	
Johnson et al. 1988		17.0				
Santucci, Jr. and Wahl 1993	0.0	7.0	20.0	0.0	4.0	10.0

Fry stockings have more commonly been evaluated by measuring the percent contribution of stocked fry to a given year class. A few successes have been documented (Carlander et al. 1960, McWilliams and Larscheid 1992, Mitzner 1992), but many more failures were found (Frey and Vike 1941; Carlander 1945; Smith, Jr. and Krefting 1954; Priegel 1971; Forney 1976; Laarman 1981; Mathias et al. 1992; Santucci, Jr. and Wahl 1993), and some authors found mixed results among lakes and years (Kempinger 1972, Schweigert et al. 1977, Jennings and Philipp 1992). No clear pattern explaining the variability in fry stocking success emerges, which is not surprising given the wide range of limnological and biological attributes among the systems studied.

Stocking Density

Fry stocking densities were found to be related to year class strength in some cases (Carlander and Payne 1977, Schweigert et al. 1977), while other investigators found no relation (Smith, Jr. and Krefting 1954; Forney 1976; McWilliams and Larscheid 1992). Carlander and Payne (1977) found the greatest contributions at stocking densities above 3,000/acre. However, Forney (1976) found no relation between stocking density and year class size at stocking densities from 3,070 to 6,060/acre. Stocking density of fingerling walleye in Minnesota lakes was not related to subsequent adult population size (Li et al. 1996a, Parsons et al. 1994).

Predators and Cannibalism

Measurable impacts on survival of young walleye have been documented from cannibalism (Chevalier 1973, Forney 1976). Chevalier (1973) found the seasonal distribution of total mortality and mortality from cannibalism of young walleye was similar in Oneida Lake, New York, supporting the hypothesis that cannibalism was the principle source of mortality. These results suggest that in systems where walleye are the dominant predator, population levels may self-regulate to some extent. The degree of self-regulation may be influenced by availability of alternative prey. Forney (1976) found that abundance of YOY and yearling yellow perch *(Perca flavescens)* explained 85% of the variability in relative survival of YOY walleye between May and August 1, 1966–73. McIntyre et al. (1987) also reported that losses to cannibalism in hatchery production ponds may be tempered by abundance of zooplankton and minnows.

Santucci, Jr. and Wahl (1993) found that largemouth bass *(Micropterus salmoides)* consumed up to 28% of the walleye stocked in a small impoundment in Illinois. Of the three size groups of walleye stocked, only large fingerling (>185 mm) were not consumed. Vulnerability to largemouth bass predation was highest immediately after stocking. Unquantified losses of stocked walleye fingerling to northern pike *(Esox lucius)* predation have also been noted (Margenau 1995).

Forage

Stocked walleye generally do not have the energy reserves to survive long periods without appropriate forage. This is particularly true for walleye stocked as fry. Jennings and Philipp (1992) found that fry stocking was more successful when small cladocerans were abundant, and Fielder (1992) concluded that small fingerling (36 mm) stocking success may have been enhanced by the abundance of zooplankton in Oahe Reservoir. Priegel (1971) matched fry stocking dates with daphnid pulses but found poor survival in four of five lakes. He concluded that daphnid abundance was not an important factor controlling fry survival. Despite great variations in copepod abundance from year to year, Houde (1967) found no correlation between copepod abundance and number of copepods in fry stomachs over a three-year period in Oneida Lake, New York. Summer abundance and mortality estimates of YOY walleye were similar from 1961 to 1963 and food levels did not appear to be a critical factor in determining mortality. Studies suggesting that a relation exists between zooplankton abundance and fry survival were conducted in reservoirs, whereas studies suggesting no relation were conducted in natural lakes. In three of the four studies, ranges of zooplankton abundance were roughly similar. The relation between fry stocking success and zooplankton abundance remains unclear.

Forage availability for stocked walleye fingerling has rarely been evaluated. Momot et al. (1977) felt that a large, early hatch of gizzard shad *(Dorosoma cepedianum)* contributed to survival of walleye, which led to a large walleye year class; however, no well-designed studies evaluating this type of relation are available for Wisconsin waters.

Genetic Issues in Walleye Stocking

Genetic issues in fisheries management programs include both adaptation affecting short-term survival of the hatchery product in recipient waters and compatibility of resident and stocked populations affecting long-term fitness and performance. The issues concern maintenance of population-level processes affecting distribution of genetic variation, which occurs at hierarchical levels within and among populations (Wright 1978).

Within-population Variation. Within-population genetic variation can be lost through inbreeding, which is a potential problem in any propagation program. Although optimizing the number of broodstock to maintain levels of within-population genetic variability is a consideration even in wild broodstock programs, variation at this level is of greater concern for captive broodstock programs. Guidelines for maintaining genetic variation at this level are readily available (Kapuscinski and Jacobson 1987) and are related to the number of individuals used to procure gametes. The use of large numbers of individuals maintains greater effective population size, reducing the probability that alleles will be lost.

Among-population Variation. Genetic variation that occurs among populations is also important to population fitness (Wright 1978). Concerns regarding among-population variation in stocking programs include (1) preserving the uniqueness of native stocks that may be specifically adapted to particular environments and (2) using genetically appropriate stocks for rehabilitation and introductory stocking, thereby enhancing the probability of success.

Studies conducted at different spatial scales and with different techniques and approaches suggest that, like most species, walleye consist of population subunits that differ from each other, rather than consisting of a single, panmictic, homogenous group. Billington and Hebert (1988), Ward et al. (1989), Todd (1990) and Billington et al. (1992) found evidence for genetic divergence of walleye populations over a wide geographic range. Both Ward et al. (1989) and Billington et al. (1992) detected broad regional patterns of allozyme and mitochondrial deoxyribonucleic acid (mtDNA) restriction fragment length polymorphism (RFLP) variation, respectively, across the native range of walleye. Fields et al. (1997) found molecular genetic evidence for stock structure on a more restricted geographic scale, including Illinois, Wisconsin, and Minnesota. Within Wisconsin, distinct walleye stocks are present in the Lake Michigan, Lake Superior, upper Mississippi River (upper Wisconsin, St. Croix, and Chippewa river basins), and lower Mississippi River drainages, although exceptions to these general patterns emerge possibly as the result of past fish transfers. At a finer geographic scale, Stepien (1995) reported segregating walleye stocks within the Lake Erie basin, where populations spawning in different rivers within the basin formed discrete groups, based on mitochondrial control region sequences.

Most genetic studies scan genetic markers, providing a relatively efficiently obtained index of accumulated evolutionary change but little insight regarding specific adaptations. Studies directly examining traits determining fitness in a particular environment are useful for lending insight regarding potential consequences of stock transfers. Jennings and Philipp (1996) stocked walleye from two populations into a system with both riverine and lentic spawning habitat, and without natural reproduction. They sampled reproductively mature walleye from a river-spawning stock in the riverine habitat and walleye from a lake-spawning stock in the lake; the distribution of fish was non-random. The results are consistent with a genetically influenced behavioral mechanism that determines choice of spawning location. Fox (1993) transferred fertilized zygotes between two river systems and evaluated short-term survival of each stock in the two environments. In each case, the native zygotes had higher survival rates consistent with a mechanism of local adaptations to the differing chemical conditions.

For Wisconsin walleye, recognizing stock boundaries as limits to distribution of fish originating within each area will reduce the risk of deleterious effects of stock mixing. In cases where transfers have resulted in exceptions to the general distribution pattern, a policy of not stocking waters with existing natural reproduction minimizes additional risk of reduced population fitness. Putting fish in waters appropriate for their biological makeup contributes to the success and cost-effectiveness of the stocking effort. Additional work is underway that follows up population genetic studies with tests of hypotheses regarding life history divergence and outbreeding depression, which should assist in quantifying genetic risks of alternative management scenarios.

Abiotic Characteristics

Several papers support the concept that abiotic characteristics of the stocked systems influence the success of stocking (Laarman 1978, Willis and Stephen 1987, Johnson et al. 1988, Bennett and McArthur 1990). Most of these authors discuss success of stocking impoundments with success defined as establishing a self-sustaining population. In an extensive review of introductory stockings in North America, Bennett and McArthur (1990) found that lake area, maximum depth, and pH were significantly related to establishing self-sustaining populations. Willis and Stephen (1987) found that stocking success in Kansas reservoirs from 500 to 16,200 acres was related to storage ratio, with poor success in impoundments having a storage ratio of 1.0 or less.

Management agencies stock for several reasons, some of which do not necessarily correspond with biological features of the systems. One common reason for maintenance stocking is expansion or diversification of angler opportunities in systems that naturally produce a different type of fishery (Heidinger 1993). Improved cost effectiveness of maintenance stocking programs would probably result from following a biologically based system that identifies recipient waters with a high probability of post-stocking survival as described for introductory stockings by Bennett and McArthur (1990). Abiotic factors related to success of maintenance stocking programs have not been well defined. As discussed earlier, fourteen papers reported fry maintenance stocking results. No clear relation was observed between lake size and stocking success as Bennett and McArthur (1990) found for introductory stocking. Furthermore, fry maintenance stocking was unsuccessful in the four largest systems. Clarification of abiotic factors related to successful maintenance stocking programs, with carefully defined measures of success, should be useful to fishery managers.

Cost/Benefit

The cost effectiveness of stocking walleye has historically been questioned. Threinen (1955) concluded that stocking for introductory purposes where natural reproduction would occur was justifiable, but fishing would not be greatly improved by the contribution of the stocked fish alone, and an increase in stocking would have been very costly. Laarman (1978) again raised the question of whether the costs of raising and stocking walleyes are justifiable. Estimated cost per fish to creel using 1995 Wisconsin DNR production costs ranged from $0.44 to $54.17 for several studies (Table 2). Actual cost per fish harvested would be higher if amortization of facilities and equipment as well as all indirect personnel costs were included in the estimate.

Table 2. *Cost per fish to creel estimates based on reported percent return to creel for small (<100 mm) and large (>125 mm) fingerling, using 1995 Wisconsin DNR production costs.* [a]

Study	Return to Creel (%)	Cost to Creel (U.S. $)
Small Fingerling		
Larson 1961		
1949	0.5	12.00
1950	1.4	4.29
1951	3.3	1.82
1952	1.7	3.53
1953	1.1	5.45
1954	9.8	0.61
1955	0.2	30.00
Kempinger 1977		
1954	13.5	0.44
1958	0.2	30.00
1959	0.8	7.50
1961	0.9	6.67
Seip 1995, Big Clear Lake 1984-87; 89	0.2	30.00
Mississagagon Lake, 1983-84; 1986-87	0.3	20.00
Sand Lake 1983-90	0.2	30.00
Thirteen Island Lake 1983-90	0.4	15.00
Large Fingerling		
Laarman 1981	3.5	18.57
Parsons et al. 1994 Lake Mary		
1986	1.2	54.17
1987	1.6	40.62
1988	2.3	28.26
Lake Ida		
1986	6.4	10.16
1987	7.7	8.44
1988	8.3	7.83
Lake Miltona		
1986	4.6	14.13
1987	6.2	10.48
1988	12.7	5.12

[a] Small fingerling — $0.06/fish; Large fingerling — $0.65/fish

Although the number of studies is limited, they suggest the higher rate of return of large fingerling does not entirely offset the increased cost of production. Additionally, these results highlight that stocking walleye is an expensive management option. Murphy et al. (1983) indirectly estimated the cost to creel of stocking 2-inch fingerling walleye in a Virginia impoundment was $27.35/fish. Mathias et al. (1992) considered the cost of harvested fish in a commercial fishery and found that at $9.12/fish harvested the costs did not justify the benefits of the fry stocking program.

Sociological Factors in Walleye Stocking

The public puts great demands on natural resources and the agencies charged with resource management. Fish species vary in their desirability to angler groups; in many parts of North America, the walleye is a highly prized sport and food fish. Thus, society demands expanded opportunity to catch walleye in more lakes and increased numbers where they already exist. Ironically, Radomski and Goeman (1995) suggested that highly visible and widespread stocking programs themselves have altered angler expectations, which contributes to constant public demand for walleye stocking in Minnesota, even in lakes not well suited for such management. Although expansion of angler opportunities is often used as a rationale for stocking, Radomski and Goeman (1995) found that such activities tend to homogenize assemblage structure, reducing the variety of fish communities regionally available. They further expressed concern that high-profile activities such as stocking appear more important to anglers than less visible but more effective long-term strategies such as habitat restoration and protection.

Stocking is widely perceived by the public as the best shortcut around biological constraints that limit populations. The variable success of stocking may be partly due to stocking inappropriate systems because of socio-political pressure. In a survey of state and provincial agency stocking programs, Fenton et al. (1996) found that although most state agencies did not know what the annual harvest of or angling effort for walleye was, the political support for walleye stocking was relatively strong. This may explain the predicted 50% increase in walleye stocking by four northern states by the year 2000, reported by Fenton et al. (1996).

The public needs a complete explanation of all the potential outcomes of walleye stocking. This would include expected walleye population levels, catch and harvest rates for a stocked fishery, as well as tradeoffs and risks associated with stocking such as impacts on resident predator and prey populations, potential genetic conservation consequences, the monetary costs to produce a harvestable size fish, and loss of fish assemblage diversity.

Summary and Recommendations

Smith, Jr. and Krefting (1954) suggested that success of natural reproduction appeared to be controlled by a complex ecological relationship with other species or climate. This is probably also true for stocking. Several factors contribute to the unpredictable outcome of any single stocking event. Those factors include the collective effects of culture technique, timing and method of harvest, and distribution methods, which influence the condition of the fish at the time of stocking. Once stocked, another set of in-lake factors contributes to variability in stocking success. These factors may be the strength of the previous year class, invertebrate and forage fish abundance, predators, basin characteristics, and parasites. The genetic suitability of stocked fish also contributes to the outcome of stocking programs. The specific status of all of these variables is rarely known prior to any particular stocking event, which likely explains why results of stocking programs are extremely variable and often unpredictable.

Despite limitations of available information, a few published studies provide clearly useful information and lead to straightforward management implications. The summaries of Laarman (1978) and Li et al. (1996a) overcome some of the shortcomings of individual case histories by using large sample sizes that provide the power to detect trends despite the variability among lakes and years. Both conclude that the least successful type of stocking is supplemental stocking, and Li et al. (1996b) further showed that supplemental stocking can have detrimental effects on adjacent year classes. Incorporating these findings into management decision making could save considerable resources for stocking programs, considering Fenton et al. (1996) reported that supplemental stocking was the highest priority in stocking programs in North America and that the four northern states with the highest stocking rates predict a 50% increase in stocking by the year 2000.

Recently, Kerr et al. (1996) independently reviewed the stocking literature. Although their efforts covered a more extensive volume of agency reports and memoranda, they reached similar conclusions to ours on several major points regarding supplemental stocking, genetic conservation, quality control within the hatchery, the need to develop lake selection criteria, and the need for well-designed evaluations.

The major findings supported by existing studies and our management recommendations are as follows:

- ❖ Supplemental stocking of systems containing naturally reproducing populations is usually not successful. Although some stocked fish survive, suppression of adjacent natural year classes leads to no increase in total population size. Therefore, systems with natural reproduction should not be stocked; management biologists need to develop a workable definition of naturally sustainable populations.
- ❖ Maintenance stocking has variable results, and factors governing success are poorly understood. Reducing stocking stress and increasing the consistency in body condition of stocked fish may reduce variability in stocking results and improve studies evaluating other factors related to stocking success.
- ❖ In studies with quantitative evaluations, stocking large fingerling (>5 inches) has not been cost effective compared to stocking small fingerling. However, the supporting literature is not exhaustive. Well-designed studies with replication and controls are needed to better understand the cost effectiveness in systems where large fingerling are perceived to be desirable.
- ❖ Local adaptation of stocked fish to recipient systems (in introductory and maintenance stocking) appears to be a factor influencing stocking success. When a system is to be stocked, attempt to select a source with life history traits best suited to the system.
- ❖ Stock transfers create risk of lowered fitness of the existing population. The extent of this risk has not been quantified. Performance and/or fitness evaluations of genetic stocks in different environments should be conducted. In addition, guidelines to minimize genetic risk (e.g., regional broodstocks) should be implemented. In situations where supplemental stocking does occur, broodstock should come from the same system.
- ❖ Important abiotic factors influencing the success of introductory stocking have been identified; however, much less is known about abiotic effects on maintenance stocking success. Individual case histories have not resulted in a clear understanding of critical factors determining success rates. Effort to evaluate stocking success should be concentrated on well-designed studies within the framework of an objectively defined lakes classification system.

Addendum

Survival of small fingerlings (± 50mm) from stocking in early summer to October was 2.5% (range 0.2–5.5%) for walleye in Lake Mendota, Wisconsin (Johnson et al. 1996) and 3.8% (range 0.0–11.6%) for saugeye in Ohio reservoirs (Donovan et al. 1997). Johnson et al. (1996) evaluated seven consecutive years of walleye stocking and found the year class from the introductory year of stocking had the highest survival based on a comparison of spring estimates (Table 3). These results were consistent with the findings of Laarman (1978). The results from Donovan (1997) come from a much larger dataset which included evaluations of 31 stocking events among ten reservoirs and four years.

Factors influencing survival of stocked fingerling included abundance of forage, which served directly as prey or indirectly as forage buffer, as well as cannibalism, predation by northern pike, and mean length at stocking (Donovan et al. 1997; Johnson et al. 1996). Donovan et al. (1997) concluded that by manipulating stocking date relative to ichthyoplankton peaks, fisheries managers can either increase saugeye size or survival to fall, but not both.

Table 3. *Summary of survival rate (S) estimates for walleye fingerlings stocked in Lake Mendota. Age-0 estimates were computed in fall as number in fall divided by number stocked. Age-1 estimates were computed as the number remaining in the following spring divided by the number stocked the previous year. Abundance data were not available in fall 1986. S.E.(S) is the standard error of the estimated survival rate. From Johnson et al. (1996).*

Year-class	Age	(%)	S.E.(S)
1986	age-0	—	—
	age-1	10.40	2.28
1987	age-0	3.18	0.50
	age-1	2.02	1.00
1988	age-0	3.64	0.58
	age-1	0.69	0.23
1989	age-0	2.17	0.41
	age-1	0.10	0.03
1990	age-0	0.20	0.04
	age-1	0.04	0.02
1991	age-0	5.53	0.75
	age-1	3.78	1.40
1992	age-0	0.24	0.03
	age-1	0.15	0.03

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