Fishery Management Plan

Solberg Lake
Price County, Wisconsin

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FOREWORD AND ACKNOWLEDGMENTS

This is a long-term strategic plan that will guide our fishery management efforts on Solberg Lake for many years to come. We believe our fishery management plans should be based upon a shared vision that is developed by combining broad-based survey information from statewide anglers and interactive input from local stakeholders. From those sources we determine user preferences in light of ecosystem capability. We believe the goals of a good plan must reflect the shared vision between users and managers; and measurable objectives must be set so we know whether selected strategies are succeeding or failing. We believe in making good tries and learning from failure. Part of that process involves amending strategic plans (like this document) when failure dictates that we either develop more realistic objectives or change our strategies to achieve reasonable objectives. This plan should be updated as needed in the decades that follow.

We call this a "long-term strategic plan" because the goals and objectives are relatively timeless, and because we possess neither the wisdom nor the authority to commit DNR or partner resources to a specific operational schedule of funding and action. Each year will bring its own fiscal constraints and operational priorities, so we must remain flexible in our implementation of proposed actions. Because there are so many complex and inter-related strategies, we have chosen to forego the lengthy process required to secure statewide DNR approval at this time. We will do our best to justify actions we believe necessary to realize our shared vision to DNR leaders and the general public as time and circumstances permit. We promise only to consult this plan at least once annually as we allocate our time and resources to the many important projects before us.

We want to thank the Solberg Lake Association and President Richard Kelnhofer in particular for hosting our local stakeholder visioning session at the Solberg Lake County Park outdoor pavilion on July 16, 2005. Their continued support for this process and this plan has given us the energy and enthusiasm needed to aggressively pursue implementation and to expand this process to other lakes in Price County and the Upper Chippewa Basin.

We also want to thank the 47 local stakeholders who gave up an entire Saturday afternoon in order to help us develop the vision that forms the backbone of this plan. We are very pleased to incorporate their input at this appropriate stage in the planning process; and we look forward to their continued support for the actions we believe will be necessary to achieve the shared vision. We can settle for nothing less in an area where the quality of fishing means so much to our livelihoods and our quality of life.

-- Jeff Scheirer and Dave Neuswanger

BACKGROUND

Habitat Characteristics and Productivity

Solberg Lake is an 859-acre impoundment on Squaw Creek, a tributary to Duroy Lake, the upstream-most lake in the Phillips Chain-of-Lakes on the Elk River system. The reservoir is located about 4½ miles north of Phillips, Wisconsin, a small city with about 1500 residents in central Price County.

Construction of the dam in 1940 formed the present-day reservoir, flooding Squaw Creek about 16 feet above its natural level. The modern-day structure is an earthen dike 23 feet high and 787 feet long. A stop-log section in the concrete spillway facilitates control of reservoir level over a 14-foot range. The dam is owned and operated by Price County and regulated by the Wisconsin Department of Natural Resources. The permit authorization for Solberg Dam includes no requirement for minimum reservoir elevation. Reservoir level is maintained 6 inches below normal in winter to prevent shoreline erosion.

Solberg Lake is one of the largest individual waterbodies in Price County, ranking second to Butternut Lake in total surface area. Solberg Lake's irregular shoreline (shoreline development = 3.0) reflects its greater potential to support littoral (near shore) communities compared to lakes with circular shape whose shoreline development factor is closer to one. The shallow water habitat associated with eleven islands scattered throughout the lake also increases the system's potential for littoral zone production. Sand makes up the majority of the littoral zone sediment along with small proportions of gravel, rubble, bedrock, and muck (Table 1). Wave action keeps the coarse substrate (gravel and rock) free of sediment along the windswept shores.

Table 1. Selected physical characteristics of Solberg Lake.

Substrate (% coverage)		Surface area (acres)	Shoreline (miles)	Maximum depth (feet)	Average depth (feet)	% surface area < 3 feet deep
Rock	25	859	12.4	16	7	15
Gravel	1					
Sand	73					
Muck	1					

The watershed or land area that drains into Solberg Lake encompasses 21 square miles of forest and wetland, most of which are held in public ownership by the U. S. Forest Service and Price County. Timber production is the primary land use, and there is no agricultural activity in the watershed. Shorelands immediately adjacent to Solberg Lake include 94% upland, 5% sedge marsh, and 1% leatherleaf bog.

Five streams flow into Solberg Lake, including Disappearing Creek on the west shore. Two dams on Squaw Creek upstream from Solberg Lake form waterfowl impoundments locally known as Upper and Lower Squaw Creek Flowages. The Department's Inventory of Dams also lists one small dam on Squaw Creek about 1500 feet downstream from Solberg Dam. We found no recorded measurements of streamflow in Squaw Creek. However, based on average runoff (12.5 inches per year) and drainage area, the average annual discharge from Solberg Dam was estimated at 19 cubic feet per second (cfs).

Solberg Lake is considered a soft-water system as reflected by its low alkalinity (21 parts per million). Its shallow average depth allows wind-induced currents to keep the lake well mixed most of the time, so the lake does not develop any significant summer thermal stratification.

Water clarity is low to moderate in Solberg Lake, where summer Secchi disk visibility has ranged from 2.3 to 7.5 feet and averaged 4.2 feet. This limits the maximum depth to which rooted aquatic plants may grow. Dissolved organic compounds draining from wetlands contribute brown-stained water to the lake. Abundant algae also decrease water clarity. Moderate algae blooms are common in Solberg Lake, and occasionally they become severe as summer progresses.

Moderate to high concentrations of total phosphorus stimulate the growth of algae, allowing us to classify Solberg Lake as eutrophic. Eutrophic waters are enriched with nutrients, making them very fertile and biologically productive. In summer, phosphorus concentration has ranged from 20 to 57 parts per billion, and chlorophyll *a* concentration has ranged from 12 to 37 parts per billion. Chlorophyll *a* concentrations greater than 20 parts per billion indicate major algae blooms. Phosphorus concentration has been higher than expected in an undeveloped watershed. Natural sources of phosphorus include groundwater and wetlands, and some internal cycling of phosphorus occurs between the lake sediment and the water column when dissolved oxygen concentration is low in mid summer and mid winter. Likely sources of excessive phosphorus include runoff of lawn fertilizer and infiltration from faulty sanitary systems along the developed shoreline.

Human Development and Public Access

Paved town roads and a ½-mile segment of unimproved private road encircle the lake perimeter. Outside the northern half of this road circuit, Price County and the U. S. Forest Service manage extensive public lands. Most of the shoreland is divided into small tracts with residences, and only about 23% of the shoreline is held in public ownership. Price County and the Town of Worcester own frontage on the northwest and northeast shores.

Outdoor recreation is important to the local economy in Price County. The permit which authorized construction of the dam lists recreation as its primary purpose. Solberg Lake and its nearby public lands offer diverse recreational opportunities for local residents and visitors year round, including fishing, hunting for waterfowl and upland game, trapping, wildlife viewing, boating, camping, and trails for motorized and non-motorized use. Price County maintains a popular day-use park and 60-unit campground at the peninsula on the northwest shore where public recreational facilities include a swimming beach, picnic area, pavilion, playground, boat ramp, fishing pier, and trails.

Several traditional resorts and long-established businesses provide services for recreational activities, including restaurants, private campgrounds, and cabin rental. All services commonly found in a small city are available within a short drive to Phillips.

Public boat access to Solberg Lake is typically sufficient to accommodate the demand without crowding. Solberg Lake has three public boat landings, and several resorts offer additional boat access without fees. Anglers can fish from shore at the fishing pier in the County Park, at all public frontage and road right-of-ways, and at numerous private docks.

Aquatic Community Overview

We can partially characterize the fish community in Solberg Lake from results of past surveys, many of which were conducted primarily to assess the walleye population. Fourteen fish species and one hybrid were captured in electrofishing and trap netting surveys from 1957 to 2003. Diversity was lower than in the nearby Phillips Chain of Lakes where the number of species per lake ranged between 16 and 25. Solberg Lake probably has greater species richness than our records indicate because of single-species targeting in past surveys and generic identification of the incidental catch. Species composition is similar to that in other regional waters where walleye, black bass (largemouth and smallmouth), and muskellunge are the principal predators. In 1960 the predominant panfish were black crappie, yellow perch, and pumpkinseed. Based on limited information, bluegill may have replaced pumpkinseed as the third most encountered panfish species in DNR fish surveys.

Aquatic plants provide food, cover, spawning substrate, and nesting habitat for many species and life stages of aquatic organisms. Emergent and submergent plants control erosion by dampening wave action. With at least 26 species present, the diversity of aquatic plants in Solberg Lake has been described as "good" and "relatively high." In 2001 the most common species in the aquatic plant community were floating-leaf burreed (*Sparganium sp*.), Canada waterweed (*Elodea canadensis*), wild celery (*Vallisneria americana*), large-leaf pondweed (*Potamogeton amplifolius*), coontail (*Ceratophyllum demersum*), and white waterlily (*Nymphaea tuberosa*). Farwell's water milfoil (*Myriophyllum farwellii*), a relatively rare "species of special concern" was found also. Growth of aquatic plants in Solberg Lake appears to vary substantially from year to year. In June 2001 aquatic plants covered an estimated 36% of the lake's surface area. In August 2002 emergent plants were generally sparse and restricted to the immediate shoreline area. There was a good mix of floating-leaf and submergent plants at low to moderate densities to a depth of about 7 feet.

Curly-leaf pondweed (*Potamogeton crispus*) is the only aquatic invasive species known in Solberg Lake. Currently present in small amounts, curly-leaf pondweed has the potential to become abundant and create nuisance conditions. Despite their proximity in the Phillips Chain-of-Lakes downstream, neither Eurasian water milfoil nor rusty crayfish have been found in Solberg Lake.

Historical Perspective on the Fishery

Local WDNR records chronicle several noteworthy transformations in the fishery since the impoundment was created. Muskellunge stocking began in 1952 and continued through 2000, usually every year but sometimes at two- or three-year intervals. At first Solberg Lake received small (2- to 4-inch) and large (9- to 13-inch) fingerlings in two or more annual shipments. After 1977 only large fingerlings were planted in late summer at stocking densities of 1 or 2 per acre in most years.

By 1960 angler success and survey results indicated "a good musky population present in the flowage" with a "growth rate for this chief predator species above the Minnesota average" (Robert Bredemus, Wisconsin Conservation Department, *Management Recommendation--Solberg Flowage*, 1960). In that report, the potential for muskies to reproduce naturally was recognized, and WDNR recommended consideration of acquisition or other protections for adjacent marshes that were important as musky spawning sites. Evidence of natural reproduction came from fall electrofishing samples in the early 1980s and 1990s when smaller wild fingerlings were captured without the distinctive traits of larger hatchery-reared fingerlings. Because of the size difference, biologists feared that larger stocked fingerlings might have a competitive advantage in survival over smaller wild fingerlings. Statewide concerns about conserving the genetic integrity of Wisconsin's native fishes prompted WDNR to suspend musky stocking in Solberg Lake in 2001 as part of a 10-year evaluation of the effects of stocking on recruitment in naturally-reproducing populations in northern Wisconsin.

Species composition of the panfish community in Solberg Lake has changed little over time, though bluegills have emerged from relative obscurity in the early 1980s to predominance today. The first but largely unsuccessful attempts to establish walleye involved the stocking of 8,100 fingerlings in 1956, 1958, and 1960 as a strategy to reduce the perceived over-abundance of black crappie. In a last-ditch effort before stocking largemouth bass (not as effective as walleye in controlling panfish), 80,000 walleye fingerlings (93 per acre) were stocked in 1961. By 1965 the heavy planting in 1961 had established a self-sustaining population, and walleye stocking was discontinued. Panfish abundance declined and growth rate improved as walleye density increased. By 1971 "panfish numbers in general appeared to be quite low," presumably because abundant young walleye were suppressing panfish recruitment. That same year the 13-inch minimum length limit on walleye was removed and 7,266 bluegill and pumpkinseed were stocked in response to "an expressed need for more panfish." However, electrofishing along 80% of the shoreline yielded only 4 bluegills in June of 1973. More recently, nearly 33,400 yearling and adult yellow perch were stocked from 1999 to 2003 with funds awarded in a grant to the Price County Forestry Department. No information is available to evaluate the success of those plants. Published evaluations of panfish stocking strategies indicate they are rarely necessary or successful in attaining objectives for bluegill, black crappie, and yellow perch. In the Upper Midwest, angler harvest and predation by young walleyes help keep panfish abundance in check, and special harvest regulations have been shown to prevent angler over-harvest of panfish.

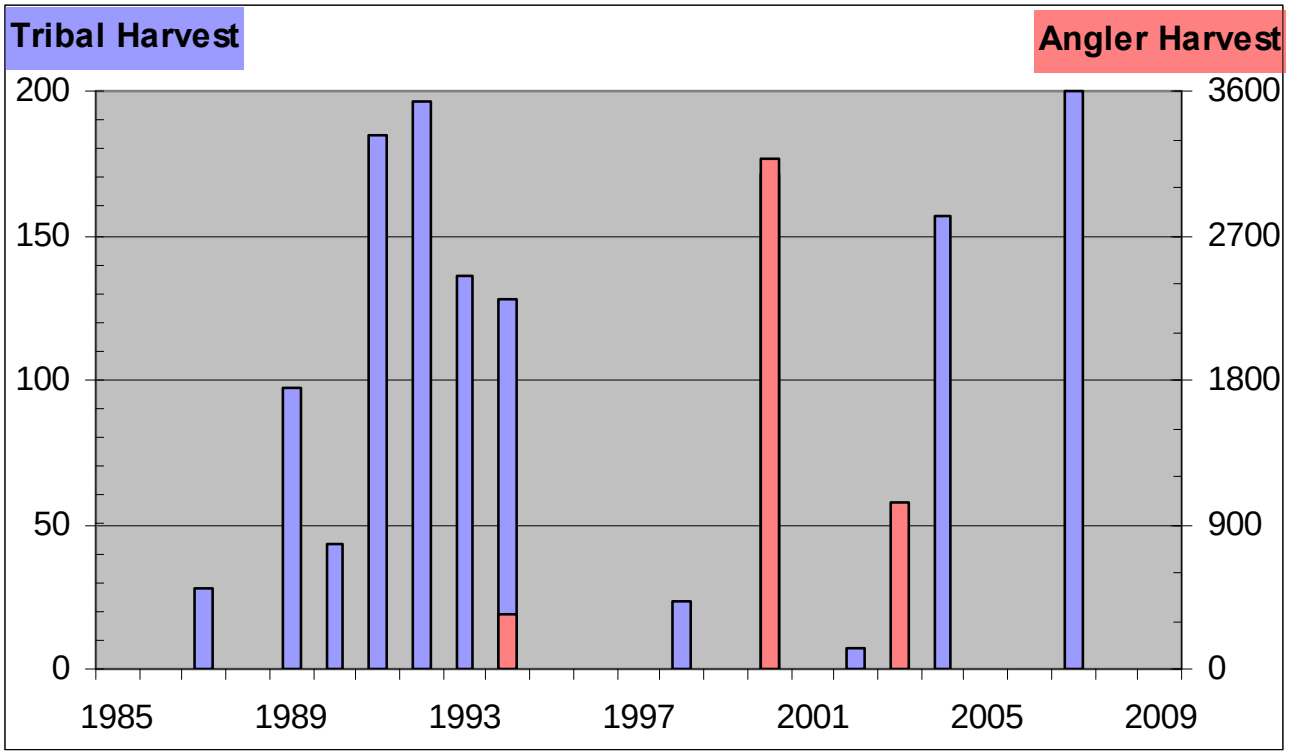
WDNR permitting records give an account of various fish habitat structures installed in Solberg Lake, including rock placed near the County Park for walleye spawning in 1977 (probably not necessary or effective, in retrospect), shoreline tree drops (generally valuable structures), and dozens of fish cribs (of questionable value, in retrospect) made from natural and synthetic materials. Most fish cribs had traditional log cabin design, but in 1994 the Solberg Lake Association purchased and installed 36 "fish condominiums" assembled from prefabricated polyethylene modules.

The most recent creel surveys on Solberg Lake in 2000 and 2003 documented average fishing pressure (32-39 hours/acre/year) compared with other lakes in Price County (38 hours/acre/year in 20 surveys) and in the Ceded Territory in northern Wisconsin (33 hours/acre/year in 374 surveys) from 1990 to 2005. Ice fishermen have contributed one eighth of the estimated annual effort.

In 2007 the Department granted permission for sponsors to hold three ice fishing tournaments on Solberg Lake in which 213 participants competed for $2,130 in prizes and registered 17 walleye, 22 northern pike, 16 black crappie, 11 bluegill, and 20 yellow perch. An unknown number of fishing contests that do not require permits are known to occur on this impoundment each year. Until May 2009, competitions involving fewer than 20 boats, 40 participants, and $500 in prize value did not require a permit from the Department.

In 1989 a sliding bag limit was established that required a reduction of the daily bag limit for walleye in lakes within the Ceded Territory where the various bands of Lake Superior Ojibwe annually declare their intent to harvest walleye by spearing in the spring. Depending on the proportion of the calculated safe harvest that tribal spearers reserve in a particular lake, sport fishing bag limits for walleye are reduced to 3, 2, 1, or 0 fish per day. If later each spring the Native American spearers decide to relinquish part of their reserved allocation of the safe walleye harvest, then sport fishing bag limits may be increased again in the open season. In recent years, bag limits have varied between 2 and 3 walleye per day in Solberg Lake. As a courtesy service to anglers, the Department posts the daily limits at public and private boat landings. Tribal spearers have taken two muskellunge from Solberg Lake since 1985 when the Lake Superior Bands of Chippewa Indians resumed exercising their hunting and fishing rights in Wisconsin. Tribal harvest averaged 114 walleyes annually between 1985 and 2009 when spearing occurred on Solberg Lake. By contrast, estimated angler harvest was 344, 3178, and 1031 walleyes in 1994, 2000, and 2003 creel surveys, respectively (Figure 1).

Figure 1. Documented harvest (actual counts) of walleye by Indian spearers from 1987 to 2009, and estimated harvest of walleye by sport anglers during three years when creel surveys were conducted (1994, 2000, and 2003).



A 15-inch minimum length limit for walleye was enacted statewide in 1990. Shortly afterward, a mechanism was established to exempt some waters from the 15-inch minimum, based on slow growth or concerns about human health from contaminants. In 1994 Solberg Lake walleye met two of four qualifying criteria for exemption: Male walleye did not grow to 13 inches long in 4 years, and ≥ 10% of walleye tested contained ≥ 0.75 mg/l mercury in skin-on fillets. As a result, the only special fishing regulation currently in effect on Solberg Lake exempts walleye from the statewide 15-inch minimum length limit. If future surveys reveal that exemption criteria are no longer met, the statewide minimum length limit for walleye must be reinstated. This is done without a vote of preference by attendees at the spring hearings of the Wisconsin Conservation Congress; but upon public notice, interested persons may request an informational hearing to learn why a particular exemption is being rescinded.

In its 2009 publication, *A Health Guide for Eating Fish in Wisconsin,* the Department of Natural Resources advised certain people to limit or avoid consumption of fish to manage risks associated with mercury contaminants. In addition to the safe-eating guidelines applicable to all inland waters, the guide offers the following special advice for Solberg Lake with respect to mercury: Women of childbearing age and children under 15 years old should not eat walleye longer than 22 inches, and they should limit their consumption of black crappie to no more than one meal per month. Men and older women should eat no more than one meal of large walleye (≥ 22 inches) per month and one meal of black crappie per week.

The Department has established fish refuges on two tributaries to Solberg Lake—one extending 200 feet upstream from the bridge on Disappearing Creek, and the other extending 300 feet upstream and downstream from the bridge on Squaw Creek, where no fishing is allowed from April 1 until the opening date of the general fishing season each year.

A Vision for the Solberg Lake Fishery

On July 16, 2005, DNR representatives Jeff Scheirer and Dave Neuswanger met with approximately 47 local stakeholders who were willing to volunteer their time to help develop a long-term vision for the fishery of Solberg Lake in Price County. Objectives of the meeting were to prioritize species of interest, and then to identify for those species the relative importance of numbers versus size and catch versus harvest. Attention was then focused on identifying the desired conditions (goals and objectives) that appear in this plan. Actual verbiage of goals and objectives for bluegill, walleye, black crappie, yellow perch, and muskellunge was developed by consensus of local stakeholders in consultation with Jeff Scheirer, who served as technical advisor to the group on what was possible. However, little attention was given to methods for achieving goals and objectives (management strategies such as harvest regulations, fish stockings, and habitat preservation or enhancement). It was understood and generally agreed that professional fishery managers would select the most appropriate strategies once goals and objectives had been developed with help from local stakeholders and adjusted to incorporate what is known about statewide angler preference and the capacity of Solberg Lake to produce what is desired.

Detailed results of the visioning session appear in the Appendix. Bluegills were more important than any other species to local stakeholders in the Solberg Lake fishery (Table A1). This clearly indicates the need for us to place greater emphasis on assessing the status of bluegill populations and managing bluegill actively in Solberg Lake and many other waters of the Upper Chippewa Basin. Among visioning session respondents to the bluegill preference questions, 42% preferred that bluegill be managed for maximum sustainable harvest, yet the same voters preferred an emphasis on size over number of bluegill by a margin of two-to-one (Table A2). An emphasis on size would be difficult if not impossible to maintain in a high-harvest fishery where anglers tend to harvest the largest fish they can catch. In the end, participants approved of objectives that place considerable emphasis on size over number. It was understood that more restrictive harvest regulations may be required to achieve such lofty size-structure objectives; and those regulations may not be consistent with the secondary interest in maximum sustainable harvest.

Walleyes were very important to local stakeholders in the Solberg Lake fishery (Table A1). An unusually high proportion of visioning session participants generally practiced catch-and-release for walleyes (15%) and valued the size of fish more than the number caught (17%); though most local stakeholders preferred a balance between numbers and size, and they preferred a balanced approach to harvest management (Table A2). Because panfish (bluegill, black crappie, and yellow perch) were so important to Solberg Lake anglers, it was agreed that a moderate to high density of walleye should be maintained not only to satisfy walleye fishing interests, but also to keep panfish populations at optimal levels via adequate predation by walleye. Fortunately, nobody at the visioning session advocated managing walleyes for maximum sustainable harvest. Therefore, prudent selection of protective length and bag limits should make it possible to achieve the desired objectives of moderate to high walleye density and better-than-average walleye size structure.

Black crappies were almost as important as bluegills and walleyes to local Solberg Lake stakeholders (Table A1). Visioning session participants generally favored a balance between numbers and sizes of crappie; though some placed a priority on size, and all were willing to forego maximum sustainable harvest in order to allow crappies to reach desirable sizes (Table A2). As with bluegill, more restrictive harvest regulations may be needed in order to achieve the selected objectives, which include maintaining a moderate proportion of crappie over 10 inches long.

Yellow perch were not quite as important as the other panfish species (bluegill and crappie), but they were more important than most sport fish to local stakeholders in the Solberg Lake fishery (Table A1). More than 40% of respondents placed greater value on size than on number of yellow perch, while the remainder preferred a balance between the two (Table A2). This moderate preference for size over number, combined with a willingness to forego maximum sustainable harvest in order to achieve ambitious size structure objectives, adds further weight to the importance of maintaining a strong walleye population (to control numbers of young panfish and keep them growing rapidly) and of carefully regulating the harvest of quality-size panfish, including yellow perch.

Attitudes toward muskellunge varied dramatically among local stakeholders in the Solberg Lake fishery. Preferences were split almost evenly among those who claimed to have high, moderate, low, and no interest in muskellunge (Table A1). Some of those recorded as having no interest actually had highly negative feelings toward muskellunge. Among respondents to the musky preference questions, two-thirds preferred a balance between numbers and size, and more than one-third would consider harvesting a muskellunge occasionally (Table A2). These preferences stand in stark contrast to the preferences of anglers at many traditional musky waters in the Upper Chippewa Basin, where great emphasis is placed on size over number, and where anglers would rarely, if ever, harvest a muskellunge. Because muskellunge are held in lower regard and are not valued as highly as "trophy" fish in Solberg Lake as in many other lakes, an objective was chosen to maintain muskellunge density at a low to moderate level that would not likely threaten our ability to achieve objectives for more important members of the fish community, such as yellow perch. Conservative size-structure objectives were chosen for muskellunge also, reflecting an interest in catching preferred- and memorable-size muskies, but not necessarily trophy-sized fish (those 50 inches and longer).

Other species of some interest to local stakeholders in the Solberg Lake fishery included smallmouth bass, largemouth bass, northern pike, black bullhead, and rock bass, in that order of descending importance (Table A1). There was insufficient time at the visioning session to develop specific goals and objectives for these less important species; but some of them must be managed nonetheless in order to achieve objectives for higher-priority species. For example, we do not want to allow largemouth bass to become dominant in the fish community, because they could eat enough young walleyes to prevent us from maintaining the desired adult walleye density. The moderate interest in bass fishing at Solberg Lake can and should be satisfied by smallmouth bass, which do not threaten walleye recruitment the way largemouth bass do. Largemouth bass and smallmouth bass should be managed differently in Solberg Lake – allowing largemouths to be harvested liberally while smallmouths are afforded perhaps even more protection than they receive currently. Northern pike were viewed more negatively than positively by local stakeholders, so harvest of those fish should be facilitated by continued liberal harvest regulations and perhaps even local harvest promotions. Theoretically, fewer pike should translate to more yellow perch – a desirable species at Solberg Lake.

Overall, this was a very positive session in which everyone, including DNR representatives, learned a great deal. We are confident that we can develop strategies that reflect the preferences and desires of local stakeholders and other anglers who visit the area.

GOAL 1: A bluegill population of moderate density with a high proportion of preferred-size fish.

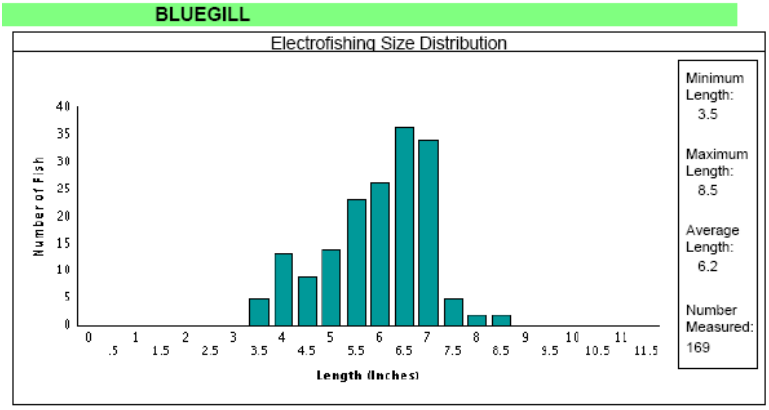
Objective 1.1: Currently we lack an effective method to assess the relative abundance of bluegill. Until an assessment method is chosen, we will consider a late spring electrofishing capture rate of 75-150 bluegill 3 inches and longer per hour of directed effort to be somewhat indicative of the desired moderate density.

Objective 1.2: Of all bluegill 3 inches and longer (stock size) captured by electrofishing in late spring, 15-20% should be 8 inches or longer (RSD_8 = 15-20%).

Bluegill Status and Management Strategies:

Past sampling of bluegill in Solberg Lake has involved fall electrofishing or mid-summer fyke netting, usually incidental to surveys targeting other fish species. We consider those methods suboptimal for purposes of characterizing relative abundance or size structure of bluegill, so comparable historical data are lacking. On the night of May 28, 2008 we expended 0.7 hour of directed electrofishing effort at three shoreline sites (1.6 miles total) to characterize the bluegill population in its spawning period and habitat – our new standard method of assessment. Capture rate of 3-inch and larger fish (hereinafter referred to as stock-size fish) was 249/hour (Table 3), exceeding the benchmark of 75-150 per hour tentatively selected to represent moderate density. The population presently does not possess the high proportion of preferred-size bluegill (8 inches or longer) that anglers desire in Solberg Lake. Only 2% of stock-size bluegills were 8 inches and larger (RSD_8 = 2%), a Relative Stock Density value well below the target range of 15–20%. We believe the strongly truncated length-frequency distribution starting at 7.5 inches (Figure 2) indicates anglers have been selectively harvesting a high proportion of the largest bluegill in the population.

Figure 2. Length frequency distribution of bluegill captured by electrofishing—May 28, 2008.



We do not believe the shortage of preferred-size bluegill can be attributed to slow growth or excessive natural mortality. Analysis of 2008 scales revealed that bluegill in Solberg Lake reached 4.6 inches (n = 7) after three full growing seasons – an indicator of satisfactory growth (only 0.2 inch below the statewide average[1] for age-3 bluegill). Bluegill measured in the 1994, 2000, and 2003 creel surveys grew to 9.5 inches, consistently demonstrating that bluegill in this productive system can grow fast enough and survive long enough to exceed preferred size. Generally, a moderate level of harvest in the past (estimated at 3.7 per acre averaging 7.1 inches during the 5/3/03-3/1/04 creel survey) would allow a moderate proportion of bluegill to attain preferred size in a productive lake. Electrofishing in fall 2003 and 1996 yielded higher RSD_8 values (Table 2), despite a bias associated with sampling at a time when large bluegill typically occupy deep water. Not long ago Solberg Lake had more bluegill longer than 8 inches, suggesting it is possible to achieve the desired size structure; and recent (undocumented) levels of harvest may have increased since the last creel survey.

[1] Accounting for the variation in length at age between northern and southern Wisconsin would narrow this gap further.

In our opinion, it is unlikely that we will achieve the bluegill size structure objective (1.2) under current regulations that permit anglers to harvest 25 panfish daily of any species with no length restrictions. We believe some combination of reduced daily bag limit and length restriction is necessary to achieve desired bluegill population density and size structure. A simple bag limit reduction may increase numbers but have no impact or even a negative influence on size if fish become overabundant and stunt in their growth. A simple minimum length limit runs the risk of stockpiling fish just under the legal length for harvest, adversely affecting growth rate and causing high natural mortality of fish before they attain legal size. A size-dependent bag limit (e.g., 25 daily, only 5 of which may be over 8 inches) would allow a desirably high level of angler harvest of small adults during times of surplus, while concurrently reducing or at least better distributing harvest of the fastest-growing adults that have attained the preferred size of 8 inches – usually "parental" (nesting) males that grow faster due to delayed sexual maturity. We await the recommendations of DNR's Panfish Standing Team – a group of biologists from throughout the State charged with developing more effective management options for panfish in Wisconsin by the end of 2010. Because RSD_8 is far below our target range, we will try to implement new regulatory options for improving bluegill size structure in time to evaluate initial impact during the next baseline monitoring survey scheduled for spring 2014. In the meantime, the Solberg Lake Association could help by actively promoting a voluntary limit on angler harvest of bluegills over 8 inches long to 5 daily as an interim strategy until more effective panfish harvest regulations can be enacted formally.

Table 2. Catch rates and size structure indexes of bluegill captured by electrofishing in Solberg Lake. PSD and RSD_8 are proportions of all bluegill ≥ 3 inches that were 6 and 8 inches or longer, respectively. "RSD_8 Goal" is Objective 1.2. Table continued in Appendix.

Date	Water temperature (°F)	Electrofishing effort (hours)	Number per hour (3 inches or longer)	PSD	RSD_8	RSD_8 Goal
May 28, 2008	60-65	0.7	249	62	2	15-20
September 24, 2003	58-59	0.4	43	88	12	--
September 24, 1996	63	1.9	32	82	10	--

GOAL 2: A walleye population of moderate to high density with a moderate proportion of quality-size fish and a low proportion of preferred-size fish.

Objective 2.1: 4-7 adult walleye per acre in spring population estimates

Objective 2.2: Of all walleye 10 inches and longer captured by fyke netting in early spring, 30-40% should be 15 inches or longer (PSD = 30-40%) and 3-7% should be 20 inches or longer (RSD_{20} = 3-7%).

Walleye Status and Management Strategies:

Estimated walleye density was within or just below the desired range of 4 to 7 adults per acre in 1994, 2000, and 2003, but the size structure of the population consistently fell short of the objective level in those years and in 2008 (Table 3). Slower-than-average walleye growth rate after Age 1 (Figure 3) and selective angler harvest of the fastest-growing walleye in the absence of a length limit are likely causes for the unsatisfactory walleye population size structure. Anglers spent more time

fishing for walleye than for any other species (39% of 40,885 hours directed effort). They harvested 12% of the adult walleye population from May 3, 2003 to March 1, 2004 (Table 4), but the average length of 110 walleye measured in the creel survey was 13.6 inches and only about 16% were 15 inches or longer.

Table 3. Estimated density, catch rates, and size structure indexes of walleye captured by fyke netting in Solberg Lake in recent years. PSD and RSD_{20} are proportions of all walleye ≥ 10 inches that were 15 and 20 inches or longer, respectively. "Goals" are Objectives 2.1 and 2.2.

Date	Estimated number of adults/acre	Adult density goal	Estimated number all sizes/acre	Net-nights	Number ≥ 10" per net-night	PSD (%)	PSD goal (%)	RSD_{20} (%)	RSD_{20} goal (%)
May 5-6, 2008	--	4-7	--	6	17	12	30-40	1	3-7
Spring 2003	3.9	--	17	92	16	25	--	2	--
Spring 2000	6.1	--	23	80	22	24	--	1	--
Spring 1994	5.3	--	18	47	35	8	--	2	--

Despite subtle differences in sampling objectives, (i.e. extensive fyke netting in several habitat types of 8 lakes to characterize walleye, northern pike, muskellunge, and yellow perch populations from April 24 to May 9, 2008 vs. intensive fyke netting effort at known spawning sites in Solberg Lake to estimate walleye density at the peak of spawning), we believe these survey results reasonably describe current status of the walleye population. A reduction in adult walleye harvest will be necessary to achieve the desired objectives of moderate to high walleye density and better-than-average walleye size structure. Recognizing the balanced but somewhat size-oriented preferences of local stakeholders along with their tendency toward catch-and-release, we recommend keeping the daily bag limit (usually three walleye), but restricting that harvest to only one fish daily over 14 inches long. Even with their slow growth, RSD values (Table 3) and ages determined from scales and spines (Figure 3) demonstrate that walleye in Solberg Lake can survive long enough to reach memorable size (≥ 25 inches) and even trophy size (≥ 30 inches). A reduced bag limit for walleye longer than 14 inches should increase the number of medium and large walleyes while still allowing some harvest of all sizes. Juveniles comprised three quarters of the total walleye density in three estimates (Table 3). Focusing some angler harvest on the abundant, slow-growing walleyes (ages 3 – 5) should serve to reduce their abundance and improve their growth without compromising goals for panfish density and size structure. Harvesting smaller and younger walleye, which theoretically contain lower levels of mercury than their larger counterparts, should help certain anglers reduce the health risks associated with eating fish. If this conservative change in harvest regulations fails to achieve Objective 2.2, then we should consider even more stringent harvest restrictions. One such option currently available would be a 14- to 18-inch slot length limit, which affords full protection to intermediate size fish with opportunities for liberal harvest of walleye less than 14 inches long and limited harvest of walleye 18 inches and longer.

Figure 3. Average length at age of walleye in Solberg Lake.

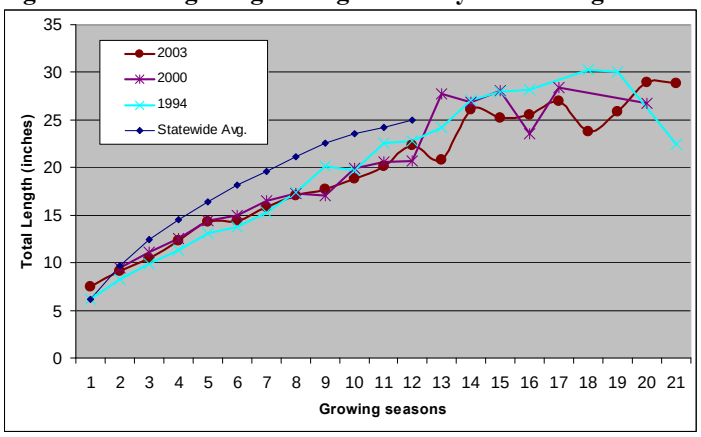


Table 4. Selected catch and harvest statistics for walleye captured by angling in Solberg Lake.

Year	Total angler effort per acre (hours)	Catch per acre	Harvest per acre	Hours of directed effort per fish harvested	Exploitation rate	Average length (inches)
2003	32	5.8	1.2	16	12%	13.6
2000	39	6.4	3.7	8.3	15%	13.7
1994	9.6	1.4	0.4	20	0.5%	12.9

Information from fall electrofishing surveys designed to evaluate the reproductive success of walleye provides convincing evidence that the population can sustain itself without supplemental stocking. Capture rates of age-0 walleye in Solberg Lake ranged from 41 to 189 per hour (average = 92 per hour) in 8 fall electrofishing surveys completed by Department staff from 1993 to 2003. By comparison, capture rate of age-0 walleye averaged 104 per hour in 94 fall recruitment surveys (1990 to 2007) on Price County lakes classified as having self-sustaining walleye populations – all much higher than region-wide averages. Although survival through their first full growing season does not necessarily guarantee that young walleyes will "recruit" and contribute to the fishery, stocking walleye would be counter-productive and should be discouraged unless other factors affecting recruitment change significantly.

GOAL 3: A black crappie population of moderate density with moderate proportions of preferred-size fish.

Objective 3.1: Currently we lack an agency-accepted standard method to assess the relative abundance of black crappie. Until an assessment method is chosen, we will consider a late spring or mid fall fyke net capture rate of 10-20 black crappie 5 inches and longer per net-night to be somewhat indicative of the desired moderate density.

Objective 3.2: Of all black crappie 5 inches and longer captured by fyke netting in late spring or mid fall, 20-40% should be 10 inches or longer (RSD_{10} = 20-40%).

Black Crappie Status and Management Strategies:

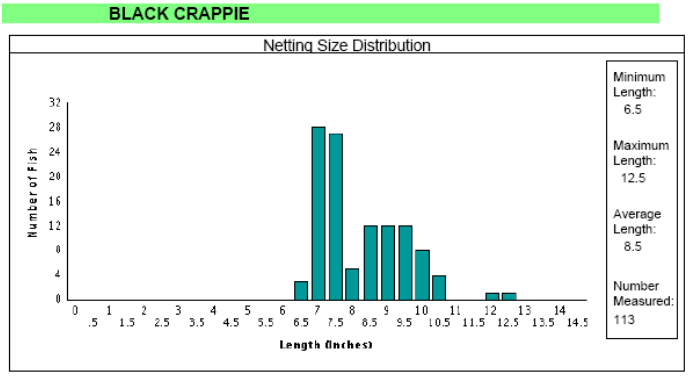
Historical inferences about black crappie abundance and size structure were based on the incidental catch in early spring fyke nets and the targeted catch in mid-summer fyke nets (Table 5). We are not sure how to interpret results of past netting surveys, but the notable difference in catch statistics from fall 2007 and spring 2008 clearly suggests that crappie population abundance and size structure are not equally represented in fyke net samples from different times of the year. On October 1-2, 2007 we expended 6 net-nights of effort to characterize the crappie population in Solberg Lake by fall fyke netting, a standard method of assessment in several states. Until we validate its application to black crappie in northern Wisconsin, we will cautiously employ fall netting in order to assess population status relative to Objectives 3.1 and 3.2.

Table 5. Catch rates and size structure indexes of black crappie captured in large fyke nets in Solberg Lake. PSD, RSD_{10}, and RSD_{12} are proportions of all crappie ≥ 5 inches that were 8, 10, and 12 inches or longer, respectively. "RSD_{10} Goal" is Objective 3.2.

Dates	Net-nights	Number per net-night (5 inches or longer)	PSD	RSD_{10}	RSD_{12}	RSD_{10} Goal
May 5 to 6, 2008	6	38	69	21	1	20-40
October 2, 2007	6	19	49	12	2	--
Mar 25 to Apr 4, 2000	80	4.9	41	29	6	--
Aug 23 to 26, 1988	20	7.3	83	50	8	--
Jun 28 to Jul 1, 1983	40	4.3	57	12	4	--

The October 2007 sample indicates that the black crappie population in Solberg Lake may have the desired abundance, but it falls short of the size structure that anglers would prefer. Capture rate of 19 crappie 5 inches or longer per net-night was near the upper end of the objective range (10 - 20 fish/net-night) considered to be somewhat indicative of the desired moderate density. Only 12% of the stock-size crappie (≥5 inches) were at least 10 inches long (RSD_{10} = 12%), an RSD_{10} value considerably below the range (20-40%) chosen to represent the desired moderate proportion of crappie 10 inches and longer. We cannot attribute this shortfall to unsatisfactory growth and survival of recruits. Length at age of crappie in Solberg Lake in 2007 was generally higher than ever before, approximating the statewide average for ages 3 to 10 (Figure 5). Crappie grew to quality size (8 inches) in 3 to 4 years, to preferred size (10 inches) in 6 years, and to memorable size (12 inches) in 8 years. The absence of fingerling and yearling crappie (< 6.5 inches) characterizes the 2006 and 2007 year classes as very weak or missing in Solberg Lake (Figure 4). At least some fish of these sizes should have appeared in the nets, if present. Sporadic crappie recruitment is not unusual in fish communities dominated by walleye populations of moderate to high density. As long as walleye remain abundant in Solberg Lake we can expect intermittent recruitment and better-than-average growth in the crappie population. We do not know how often walleye will affect crappie year class strength, nor do we know how many young crappie will survive to adulthood after one more year at sizes vulnerable to predation by abundant walleye.

Figure 4. Length frequency distribution of black crappie captured in fyke nets—October 1-2, 2007.

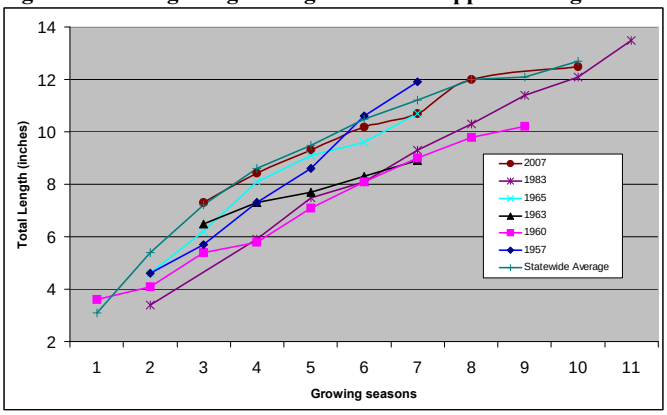


We believe the unsatisfactory size structure stems from anglers selectively harvesting a high proportion of the largest crappies in the population once a strong year class reaches some harvestable size. Although documented harvest was not excessive (estimated at 0.9 per acre during the May 3, 2003 – March 1, 2004 creel survey), average length of crappie taken in that period was 10.8 inches (range = 9.0 to 13.2 inches). Crappie populations are known to be particularly cyclic and sensitive to exploitation by angling. Their abundance often fluctuates with reproductive success, and it can decline precipitously when anglers harvest a high percentage of the adult population, rebounding only

after fishing pressure subsides and more young fish are recruited to the population. Fluctuations in crappie abundance related to harvest will most likely continue in the wake of moderate fishing pressure (estimated at 6.9 directed angling hours per acre per year in the 2003 – 2004 creel survey), though more restrictive harvest regulations could help to distribute the harvest more equitably among anglers and years.

In light of local and statewide angler preference to catch and keep crappies, it is unlikely that we will achieve the crappie population objectives in this plan under current regulations that permit anglers to harvest 25 panfish daily of any species with no minimum length limit. Consequently, some combination of reduced daily bag limit and minimum length limit may be necessary in order to achieve and more consistently maintain desired crappie population density and size structure. A 10-inch minimum length limit combined with a 10-daily bag limit (currently unique to Turtle-Flambeau Flowage) seems like a viable option for Solberg Lake, as long as the walleye population remains strong and crappie do not overpopulate. Excessive crappie density could result in slow growth rate and a higher-than-desired natural mortality of crappie that have not yet achieved some minimum harvestable size – a situation we wish to avoid. Although currently not available as a management tool, a 10-inch minimum length limit coupled with a 10-daily bag limit would reduce the risk of boom-or-bust crappie fishing characterized by rapid over-harvest of occasional year classes once they reach harvestable size. We will give serious thought to proposing more restrictive crappie harvest regulations in time to evaluate their initial impact during the next baseline monitoring survey scheduled for fall 2013. In the meantime, the Solberg Lake Association could actively promote a voluntary bag limit of 10 crappie per day with a 10-inch minimum length limit as an interim strategy until effective panfish harvest regulations can be formally enacted.

Figure 5. Average length at age of black crappie Solberg Lake.



Crappie anglers often ask about fish cribs. Adding more fish cribs in Solberg Lake is not considered necessary or desirable at this time. Fish cribs are known to improve angler success and increase harvest by concentrating fish in known locations. However, there is no scientific evidence to demonstrate that fish cribs serve to increase the total number or the total biomass of fish populations. In fact, inadvertently expediting harvest by concentrating fish at cribs could work against strategies to improve crappie abundance and size.

GOAL 4: A yellow perch population of moderate density with a moderate to high proportion of preferred-size fish.

Objective 4.1: It is difficult to accurately assess perch abundance by using traditional survey methods, but we will examine the utility of early spring fyke netting data. As methods are developed for assessing perch abundance, we will update this objective with appropriate parameter values.

Objective 4.2: Of all yellow perch 5 inches and longer captured by fyke nets in early spring, 10-15% should be 10 inches or longer (RSD_{10} = 10-15%).

Yellow Perch Status and Management Strategies:

We have very little experience assessing yellow perch populations of inland waters in Wisconsin, so we await the recommendations of DNR's Panfish Committee – a group of biologists from throughout the State charged with developing more effective sampling methods and management options for panfish. Our capture rate in early spring 2008 fyke nets in Solberg Lake (Table 6) was within the range (20-40 yellow perch 5 inches and longer per net-night) selected as an interim objective to represent the desired moderate density in nearby Connors Lake. The absence of perch < 5 inches long and dozens of 5- to 6-inch perch "gilled" in the ¾-inch bar mesh suggest that stock-size perch were not fully vulnerable to capture in fyke nets—a source of bias which would inflate indices of population size structure. Nonetheless, our spring netting reveals that the perch population has not achieved the desired size distribution in Objective 4.2. We cannot point to a definitive cause for this underperformance. However, angler harvest and predation by adult muskellunge are known to decrease size structure indices by selectively cropping the largest individuals from the population. Until we can compare results from this survey method in other waters over several years, we cannot make conclusive statements about population status.

Table 6. Catch rates and size structure indexes of yellow perch captured by fyke netting in Solberg Lake. PSD and RSD_{10} are proportions of all yellow perch ≥ 5 inches that were 8 and 10 inches or longer, respectively. "RSD_{10} Goal" is Objective 4.2.

Dates	Net-nights	Number per net-night (5 inches or longer)	PSD	RSD_{10}	RSD_{10} Goal
May 5 to 6, 2008	6	34	14	0	10-15
Mar 25 to Apr 4, 2000	80	1.6	29	1	--

We do not know whether angler harvest is responsible for the mediocre size structure of the population, or whether the low proportion of perch 8 inches and larger has caused disappointed anglers to forego fishing for perch. Anglers kept only about 0.5 yellow perch per acre (averaging 8.8 inches long) during the May 3, 2003 to March 1, 2004 creel survey. Although rare, the largest perch measured in the creel were 11.4, 10.9, and 10.4 inches long in 1994, 2000, and 2003, respectively—encouraging indications that perch can attain and even surpass preferred length (10 inches) in this productive system. Amid evidence of low angler harvest, we suspect a high natural mortality among the largest perch even before they reach harvestable size. Maintaining the muskellunge population at a low to moderate density (Goal 5 below) through natural reproduction without supplemental stocking and under statewide harvest regulations should serve to reduce predation on larger perch. Under modest exploitation (assumed), protecting perch to a certain size would offer little value toward improving size structure because a substantial proportion above the minimum length limit will die from natural causes. However, a reduced bag limit from 25 to 10 panfish per day is consistent with achieving our objectives. We will likely recommend a reduced daily bag limit of panfish in time to evaluate its initial impact in the next baseline monitoring survey scheduled for spring 2014. In the meantime, the Solberg Lake Association could actively promote a voluntary bag limit of 10 panfish per day as an interim strategy until effective panfish harvest regulations can be formally enacted.

We have no information to assess the recruitment of yellow perch, but slower than average growth of walleye after age 1 (Figure 3) indirectly suggests that juvenile perch, the preferred food of walleye, may be in short supply in Solberg Lake. If spine analysis reveals that perch growth rate is average or better, then submerging a moderate amount of natural woody structure, preferably whole coniferous trees with branched complexity still intact, along the shoreline and near-shore zone could

enhance reproductive success of perch for several years by providing additional substrate for egg deposition one to two feet below the surface where the most damaging ultraviolet rays are attenuated. Additional forage could in turn improve growth rates of walleye and other sportfish. Such a project, if completed according to plans approved by WDNR Water Regulations and Fisheries Management programs, could offset losses of woody structure previously removed from developed shorelines and increase production of attached organisms that form the base of the food web. This habitat enhancement will require periodic replacement to ensure its continued effectiveness as branching complexity deteriorates over about 3-5 years. The short life expectancy will also provide ample opportunity to carefully control unanticipated conditions that could favor largemouth bass, impair yellow perch growth rate, or otherwise compromise objectives for important sportfish in this plan.

GOAL 5: A muskellunge population of low to moderate density with moderate proportions of preferred- and memorable-size fish.

Objective 5.1: 0.1 to 0.2 adult muskellunge per acre in spring population estimates.

Objective 5.2: Of all muskellunge 20 inches and longer captured by fyke netting in early spring, 20-40% should be 38 inches or longer (RSD_{38} = 20-40%) and 10-20% should be 42 inches or longer (RSD_{42} = 10-20%).

Muskellunge Status and Management Strategies:

Estimates of muskellunge density are lacking, and it is unlikely that we will be able to obtain a valid estimate in the foreseeable future. Though capture rate is not necessarily a predictor of density, our spring 2008 fyke net capture rate was slightly above the average (~0.9 fish/net-night) from 320 surveys of Wisconsin muskellunge populations completed since 1999. Capture rate in Solberg Lake ranked above the 75th percentile statewide among classified populations that provide the best sport fishing opportunities and are sustained by natural reproduction. Consistent with these observations, anglers in Solberg Lake caught muskellunge substantially faster than the average rate of 28 hours/fish in waters (surveyed 1990 – 2003) with natural reproduction of muskellunge. Specific angler catch rates from creel surveys on Solberg Lake in 1994, 2000, and 2003 were 16.5, 18.8, and 11.2 hours/muskellunge. With the possible exception that adult muskies are eating the largest yellow perch available, it does not appear that the current level of muskellunge abundance is interfering with our ability to meet objectives for abundance and size structure for other important sportfish populations.

Table 7. Catch rates and size structure indexes of muskellunge captured by fyke netting in Solberg Lake. PSD, RSD_{38}, and RSD_{42} are proportions of all muskellunge ≥ 20 inches that were 30, 38, and 42 inches or longer, respectively. "RSD_{38} Goal" and "RSD_{42} Goal" are Objective 5.2.

Dates	Net-nights	Number per net-night (20 inches or longer)	PSD	RSD_{38}	RSD_{38} Goal (%)	RSD_{42}	RSD_{42} Goal (%)
May 5 to 6, 2008	6	1.3	100	38	20-40	25	10-20
Apr 18 to May 12, 2003	92	0.3	68	4	--	0	--
Mar 25 to Apr 4, 2000	80	0.4	75	21	--	11	--
Apr 14 to Apr 21, 1994	47	0.7	74	11	--	6	--

Although small sample size dampens our confidence in making conclusive statements about population size structure, the eight muskellunge captured in spring 2008 fyke nets indicate that the population currently has a moderate proportion of preferred- and memorable-size fish, meeting or surpassing the benchmarks in Objective 5.2 and showing a noticeable improvement from earlier assessments (Table 7).

Fall electrofishing samples in 2002 and 2003 included muskellunge fingerlings 8.5 to 10 inches long and yearlings 16 to 17 inches long (presumed ages), indicating that natural reproduction has been contributing new recruits to the population after DNR stopped stocking large fingerlings in 2000. Stocking will remain suspended until at least 2012 as part of a statewide evaluation of the contribution of stocked muskellunge in waters with some natural reproduction. Those results coupled with a planned assessment of muskellunge recruitment by electrofishing in fall 2013 should help us determine whether resumed stocking is necessary, and if so, what stocking rate and frequency are appropriate to sustain population density at 0.1 to 0.2 adult per acre

Table 8. Percentage of total fishing effort directed toward selected species in Solberg Lake in open water period.

Species	1994	2000	2003
Black crappie	15	13	16
Bluegill	15	13	18
Muskellunge	16	13	15
Walleye	34	37	38
Yellow perch	9.7	8.8	4.6
Total (hours)	11,000	57,380	34,068

Preferences were almost evenly split among visioning session participants who claimed to have high, moderate, low, and no interest in muskellunge (Appendix A1), but Solberg Lake anglers consistently directed about the same proportion of their fishing effort toward muskellunge as they did toward the more highly-regarded bluegill and black crappie (Table 8).

Although interpreting scales usually underestimates the true age of adult muskellunge, combined analysis of scales from 16 male, 2 female, and 10 muskellunge of undetermined gender revealed that growth rate in Solberg Lake was slower than average for all ages in 2000 (Table 9). The population was comprised of many age classes, allowing us to conclude that the fishery is not critically dependent

Table 9. Average, minimum, and maximum lengths (inches) at various ages determined from scales of muskellunge in Solberg Lake, spring 2000.

Age (observed annuli)	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Average Length				24.3		29.6	30.1	35.1	36.8	40.0	37.0			42.0
Minimum Length				21.6		29.5	26.8	32.5	32.9					
Maximum Length				26.5		29.6	34.8	38.5	42.5					
Count				3		2	7	6	7	1	1			1
Statewide Average Length	11.8	16.8	21.5	25.9	29.4	31.8	34.5	37.0	38.5	41.0	42.0	43.0		

upon consistent natural recruitment or annual stocking. Solberg Lake muskellunge attained minimum harvestable length (34 inches) during their seventh or eighth growing season. Slow growth becomes inconsequential toward attaining Objective 5.2 if enough individuals live long enough to reach memorable size. With a strong catch-and-release ethic among ardent musky anglers, we suspect that few memorable-size muskellunge are intentionally taken in the Solberg Lake or elsewhere. However, recent WDNR research indicates that fishing with live suckers on single-hook "swallow" rigs results in unacceptably high delayed mortality (83% within a year of catch) despite the impression that gut-

hooked fish swim away fine after the line is cut. We do not know how popular single-hook sucker rigs are among Solberg Lake anglers, but we are certain that successful live release is essential to maintain the desired fishery (Objectives 5.1 and 5.2).

Because the population currently has the desired size structure, we see no need to depart from the statewide 34-inch minimum length limit for muskellunge Solberg Lake at this time. Anglers interested in keeping a muskellunge occasionally can select from those between 34 and 38 inches long without jeopardizing goals for population size structure. Reducing muskellunge density slightly should in turn decrease predation of the larger yellow perch and improve our chances for success in attaining objectives for perch abundance and size structure.

Other Species Status and Management Strategies:

Netting and electrofishing in spring 2008 also yielded information about other sportfish populations of some interest to local stakeholders in the Solberg Lake fishery (Tables 10 and 11). Although we did not develop specific goals and objectives for the species of lesser importance in Appendix A1, several of them will require management attention, if we hope to achieve objectives for higher-priority species in this plan.

Late spring 2008 electrofishing indicated low-density black bass populations with mediocre size structure (Table 10) and virtually no legal-size fish longer than 14 inches. Nearly 42% of smallmouth bass 7 inches and larger were 11 inches or longer (PSD = 42%), but none were longer than 14 inches, the preferred size for smallmouth bass and the legal size for both black bass species. About 10% of largemouth bass 8 inches and larger were also at least 12 inches long (PSD = 10%), but none exceeded 15 inches (preferred size). Capture rate of largemouth bass was nearly twice that of smallmouth bass. We believe that changing climatic and habitat conditions (shorter ice-covered period, clearer water, and expanding aquatic plant beds), protective harvest regulations (7-week catch-and-release season and 14-inch minimum length limit) and angler attitudes (strong catch-and-release ethic) all favor the survival of largemouth bass, increasing the risk that largemouth bass could displace walleye as the dominant sportfish in Solberg Lake. Although abundance presently is not a serious concern, if capture rate of largemouth bass $\geq$ 8 inches increases to 10 - 20 per hour in spring electrofishing, then we will likely recommend liberalization of largemouth bass harvest in order to maintain satisfactory walleye recruitment. (Largemouth bass and walleyes probably are intra-guild predators that eat each other's young and compete for selected food, especially yellow perch.) Other corrective measures may include largemouth bass harvest promotions and reservoir drawdown to control aquatic vegetation and other conditions that favor largemouth bass or inhibit reproductive survival of walleye. Meanwhile, we encourage anglers to keep and responsibly consume legal numbers of largemouth bass over 14 inches long.

Table 10. Catch rates, Proportional Stock Density (PSD), and Relative Stock Density of preferred length fish (RSD_P) of other species captured by electrofishing on May 28, 2008 at water temperature 60 – 65 °F. RSD_P is the proportion of stock-size fish ≥ preferred length.

Species	Electrofishing effort (hours)	Number per hour (stock length or longer)	Stock length (inches)	Preferred length (inches)	PSD	RSD_P
Largemouth bass	2.5	8.5	8	15	10	0
Smallmouth bass	2.5	4.8	7	14	42	0
Rock bass	0.7	44	4	9	60	0
Pumpkinseed	0.7	16	3	8	82	9

Our spring 2008 fyke nets in Solberg Lake were set too late after ice-out to capture northern pike at the peak of their spawning activity, so that sample may not properly characterize adult population abundance and size structure. Nonetheless, our catch statistics do corroborate the negative sentiments of local stakeholders who held pike in low regard because of the high abundance of small fish (Table 11). Liberal harvest under current regulations that allow anglers to keep 5 pike of any size daily should serve to reduce predation on large perch, thereby increasing yellow perch size indexes toward their objective levels (4.2). The Solberg Lake Association may wish to distribute information via newsletter or demonstrate effective methods to facilitate harvest and utilization of small northern pike, including fishing tips, filleting techniques, pickling recipes, etc.

Table 11. Catch rates and size structure indexes of northern pike captured by fyke netting in Solberg Lake. PSD and RSD_{28} are proportions of all northern pike ≥ 14 inches that were 21 and 28 inches or longer, respectively.

Dates	Net-nights	Number per net-night (14 inches or longer)	PSD	RSD_{28}
May 5 to 6, 2008	6	1.7	10	0

GOAL 6: A diverse native fish community that fluctuates in species composition but generally experiences no net loss of native fish species and provides adequate forage for sport fish populations.

Objective 6.1: No net loss of native fish or other aquatic species, as documented by periodic baseline monitoring surveys.

Objective 6.2: Adequate forage, as reflected by satisfactory growth rates and condition factors of panfish and sport fish populations managed under Goals 1-5.

General Ecosystem Status and Management Strategies:

Adequate year-round water quality is vital to maintain sport fish populations with acceptable growth rates and size structures.

Introduction of invasive exotic species should be discouraged by the Solberg Lake Association via direct communications to their membership and appropriate signing at local businesses and public access areas.

Support for good shoreland management along privately-owned shorelines would help to prevent excessive input of nutrients. Maintaining wild shorelines and wide buffer strips between managed lawns and the lake will be helpful in achieving the goals and objectives of this plan. Minimizing the input of phosphorus and nitrogen from lawns or faulty septic systems will minimize nuisance plant growth and the ultimate decay of those plants that depletes oxygen and kills fish. Wild shorelines can exist on well-managed private properties as well as public lands.

Summary of Local DNR Recommendations and Action Items

- We propose to capture and process **bluegill** in late spring electrofishing samples again in 2014 and every six years thereafter. Trained volunteers could help us further assess growth and survival of bluegill by collecting scales from fish harvested from November through mid-May (5 scales per ½-inch group 6 to 9 inches long). We will try to implement new regulatory options for improving bluegill size structure in time to evaluate initial impact in the next survey. In the meantime, the Solberg Lake Association could promote a voluntary limit on angler harvest of bluegills over 8 inches long to 5 daily.

- We propose to gather catch-rate and size-structure data by early spring fyke-netting again in 2014 and every six years thereafter to closely monitor the **walleye** population. Stocking walleye should be discouraged at this time. We recommend keeping the daily bag limit (usually three walleyes after tribal declaration), but changing the current rule to restrict harvest to only one fish daily over 14 inches long.

- We propose to capture and process **black crappie** in early fall fyke nets again in 2013 and every six years thereafter, if we have determined that this method will allow us to confidently assess crappie abundance and size structure in Solberg Lake. We will give serious thought to proposing more restrictive crappie harvest regulations to improve population size structure. As an interim strategy, the Solberg Lake Association could actively promote a voluntary bag limit of 10 crappies per day with a 10-inch minimum length limit. Adding more fish cribs in Solberg Lake is not considered necessary or desirable at this time.

- We propose to capture and process **yellow perch** in early spring fyke-netting surveys again in 2014 and every six years thereafter. Trained volunteers could help us assess growth and survival of yellow perch by collecting spines from fish harvested from November through April (5 scales per ½-inch group 6 to 10 inches long). We will likely recommend a reduced daily bag limit of panfish in time to evaluate its initial impact in the next baseline monitoring survey scheduled for spring 2014. If spine analysis reveals that perch growth rate is adequate, then adding submerged woody structure in the near-shore zone could enhance reproductive success of perch and in turn improve growth rates of walleye and other sportfish.

- We propose to gather catch-rate and size-structure data by early spring fyke-netting again in 2014 and every six years thereafter to closely track the **muskellunge** population. We propose to assess reproductive success of muskellunge by electrofishing in fall 2013. We see no need to depart from the statewide 34-inch minimum length limit for muskellunge in Solberg Lake at this time. Stocking will remain suspended until at least 2012 as part of a statewide evaluation of the contribution of stocked muskellunge in waters with some natural reproduction.

- We encourage anglers to keep and responsibly consume legal numbers of **largemouth bass** over 14 inches long.

- The Solberg Lake Association may wish to distribute information via newsletter or demonstrate effective methods to facilitate harvest and utilization of small **northern pike**, including fishing tips, filleting techniques, pickling recipes, etc.

- The Solberg Lake Association should actively promote prudent shoreland management and actively discourage introduction of invasive species.

APPENDIX

Results of Visioning Session for Stakeholders in the Fishery of Solberg Lake in Price County, Wisconsin

Date: July 16, 2005
Time: 1:00 p.m. to 5:00 p.m.
Place: Solberg Lake County Park pavilion northeast of Phillips, WI
Facilitator: Dave Neuswanger, Fisheries Supervisor, Upper Chippewa Basin, WDNR
Technical Advisor: Jeff Scheirer, Senior Fisheries Biologist, Park Falls, WDNR
Profile of 47 Participants:

Lakeside Landowners – 42
Area Anglers – 3
Fishing Guides – 0
Business Owners – 0
Others – 2 (Assistant Dam Keeper; State Representative Mary Williams)

Table A1. Levels of sport fishing interest among visioning session participants in fish species nominated for consideration at Solberg Lake.

Fish Species Nominated	Level of Participant Fishing Interest			
	High	Medium	Low	None
Bluegill	32	7	1	0
Walleye	28	8	0	0
Black Crappie	25	13	0	0
Yellow Perch	16	15	4	2
Muskellunge	11	9	10	9
Smallmouth Bass	7	10	11	8
Largemouth Bass	4	11	16	6
Northern Pike	3	6	24	5
Bullheads	4	6	7	17
Rock Bass	4	3	10	17

Table A2. Preferences for numbers versus size and catch versus harvest among visioning session participants for fish species perceived to be most important at Solberg Lake.

Important Fish Species	Preference for Numbers versus Size			Preference for Catch-and-Release versus Harvest		
	Emphasis on Number over Size	Prefer Balance	Emphasis on Size over Number	Emphasis on Catch and Release	Prefer Balance	Emphasis on Maximum Sustainable Harvest
Bluegill	2	11	22	3	16	14
Walleye	0	29	6	5	29	0
Black Crappie	0	25	9	5	29	0
Yellow Perch	0	20	14	5	26	0
Muskellunge	0	18	9	17	8	2

Table A3 (continuation of Table 2 on page 12). Catch rates and size structure indexes of bluegill captured by electrofishing in Solberg Lake. PSD, RSD_8, and RSD_{10} are proportions of all bluegill ≥ 3 inches that were 6, 8, and 10 inches or longer, respectively.

Date	Water temperature (°F)	Electrofishing effort (hours)	Number per hour (3 inches or longer)	PSD	RSD_8	RSD_{10}
September 20, 1995	57	4.3	1.6	--	--	--
October 5, 1993	48-51	3.6	14	94	2	0
September 30,1992	58	4.6	5.0	70	0	0
September 17,1991	60-62	3.1	19	33	0	0
October 25, 1990	45-49	4.8	0	--	--	--
October 6, 1983	--	2.7	0.4	--	--	--
June 13, 1973	--	2.5	1.6	--	--	--
May 12 & 18, 1970	--	6	0	--	--	--
September 8, 1965	--	50% of shoreline	0	--	--	--
September 4, 1963	--	50% of shoreline	0	--	--	--
May 4 & 31 and June 1, 1960	--	75% of shoreline	0	--	--	--