Fishery Management Plan

Phillips Lake Chain, 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 the Phillips Lake Chain (Duroy, Elk, Long, and Wilson lakes) 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 realistic 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 have 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 annually as we allocate our time and resources to the many important projects before us. We thank WDNR Water Resources Biologist Craig Roesler for sharing data and insights from the aquatic plant survey conducted on Wilson Lake in September of 2007, thereby helping us to develop an appropriate perspective on aquatic plant management as it affects fishery management.

We also thank the Phillips Chain O'Lakes Association for hosting our local stakeholder visioning session at the Phillips High School Auditorium on March 18, 2005. Their support for this process and this plan has given us the energy and enthusiasm needed to pursue implementation and to expand this process to other lakes in Price County and the Upper Chippewa Basin.

We especially thank the 24 local stakeholders who gave up an entire Friday evening 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

The Phillips Chain of Lakes is comprised of 1,236 acres of impounded water along the Elk River, making it one of the largest waterbodies in Price County (second only to the Pike Chain of Lakes in total surface area). About 40% of the area of these impoundments lies within the city limits of Phillips, Wisconsin in central Price County. Before dam construction, the waters presently known as Duroy, Elk, and Long lakes were natural lakes. In their unimpounded condition, Duroy and Elk lakes had expansive surface areas and moderate depths (8 to 15 feet), whereas Long Lake had a narrow, elongated shape and a maximum depth of about 44 feet. Wilson Lake, now sometimes called Wilson Creek Flowage, did not exist before these waters were dammed. Historically, Wilson Creek entered the Elk River as a narrow tributary coursing through a wetland.

The Tannery Dam, built in 1880 near the Highway 13 bridge and razed sometime between 1933 and 1941, increased the level of Elk and Duroy lakes about five feet. Construction of Jobes Dam in 1934 formed the present-day reservoir complex, raising the elevation of the entire chain of lakes about 10 feet above the natural water level. Jobes Dam failed in 1943, and it was rebuilt later that year. The modern-day structure is an earthen dike 16 feet high and 285 feet long. The gated spillways, which were renovated in 1995, facilitate control of reservoir level over a 10-foot range. The dam is owned and operated by Price County and regulated by the Wisconsin Department of Natural Resources. The permit authorization for Jobes Dam includes no requirement for minimum reservoir elevation. Reservoir level is maintained 6 inches below normal in winter in order to prevent shoreline erosion.

Long Lake has a deep and steep-sided basin with coarse substrates in a relatively narrow littoral zone near shore (Table 1). In contrast, the basin of Wilson Lake is relatively flat and shallow with fine substrate rich in organic material, characteristics reminiscent of the wetlands in this area before impoundment. The basin features of Duroy and Elk lakes are somewhat intermediate between those of Long and Wilson.

Table 1. Selected physical characteristics of the Phillips Chain of Lakes.

		Duroy	Elk	Long	Wilson
Surface Area (acres)		348	88	418	350
Shoreline Length (miles)		8.0	2.7	11.8	9.3
Maximum Depth (feet)		18	25	54	11
% Surface Area < 3 feet deep		27	12	8	16
Substrate	Boulder	--	--	xx	--
	Rubble	--	--	xx	xx
	Gravel	12	15	xx	xx
	Sand	72	80	xx	xx
	Muck	16	5	xx	xx

The watershed or land area that drains into the Phillips Chain encompasses 216 square miles of forest with numerous wetlands. Some limited livestock grazing, hay and row crop cultivation, and dairy production take place; but for the most part there is very little agriculture in the watershed. Seven streams flow into the chain, including the Elk River, the Little Elk River, Squaw Creek, and Wilson Creek. The Department's Inventory of Dams lists at least 17 large and small dams on various tributaries upstream from Jobes Dam. We found no recorded measurements of streamflow in the Elk River. However, based on drainage area and average runoff (12.5 inches per year), the average discharge from Jobes Dam was estimated at 199 cubic feet per second over the course of a typical year

Water clarity is relatively low in the Phillips Chain. In summer, average Secchi disk visibility ranges from 3.1 feet in Wilson Lake to 4.2 feet in Long Lake. Dissolved organic compounds draining from wetlands contribute brown-stained water to the Chain. Along with the dark water color in each lake (averaging 90 to 148 platinum-cobalt units in summer), abundant algae also contribute to low water clarity. Severe blue-green algae blooms occur most frequently in Wilson Lake and occasionally in Elk and Long lakes. Low water clarity inhibits light penetration and limits the maximum depth where rooted aquatic plants can grow.

High concentrations of total phosphorus (the nutrient most responsible for high algal production) and chlorophyll *a,* an index of algal biomass, allow us to classify the Phillips Chain as eutrophic. Eutrophic waters are enriched with nutrients, making them very fertile and biologically productive. In summer, average phosphorus concentration in each lake ranges from 61 to 72 parts per billion, and chlorophyll *a* concentrations range from 9 to 28 parts per billion. Most of the phosphorus originates from natural sources, and its concentration is higher than expected in an undeveloped watershed. Musser Flowage, located on the Elk River about 7 miles upstream from the Phillips Chain, is also considered eutrophic. Other potential sources of phosphorus in the water column include agricultural, urban, and residential runoff, discharge from the municipal wastewater treatment plant, and lake sediment.

The Phillips Chain of Lakes and the Elk River are considered soft-water systems, based on low calcium hardness in the four lakes (38-50 parts per million) and the low alkalinity of Elk and Wilson lakes (45-46 parts per million). Average pH is nearly neutral to slightly alkaline, ranging from 7.2 to 7.8 in the four lakes.

Because summer thermal stratification in Duroy and Wilson Lakes is weak and intermittent, formation of a true hypolimnion (cold bottom layer of water deficient in dissolved oxygen) is rare. Shallow average depth allows wind-induced currents to keep Duroy and Wilson lakes well mixed most of the time. However, very low dissolved oxygen concentrations have been measured in the bottom 3 feet of water in both lakes during calm periods in late summer. By contrast, Elk and Long lakes typically develop a pronounced and stable summer thermocline. Very low dissolved oxygen concentrations are commonly present at depths below 10 to 13 feet in late summer. Low dissolved oxygen concentration near the bottom allows phosphorus to be released from lake sediment. Phosphorus levels increase in each lake as summer progresses.

Human Development and Public Access

The perimeter of the Phillips Chain borders on a mix of developed frontage and natural shorelands that support a variety of land uses. The shoreline of Duroy and Elk lakes retains much of its natural character, even though these waters are adjacent to a city with 1,500 residents. The wetland topography prevents development on the east side of Duroy, and several parkways and open areas on Elk Lake have been set aside for public recreation, including athletic fields, a river walkway, a swimming beach, a playground, and picnic areas.

Most shoreland residential development on the Chain is concentrated on Wilson and Long lakes, yet much of the shoreline on these lakes also has natural vegetative cover. Other land uses surrounding the Phillips Chain include the Price County Fairgrounds, the Price County Airport, a golf course, two cemeteries, and several manufacturing industries that specialize in forest products, plastics, packaging machinery, and metal plating. The sewage treatment plant discharges municipal and industrial wastewater and the plastics manufacturing company discharges non-contact cooling water into Elk Lake under permits issued by the Department.

Outdoor recreation is important to the local economy in Price County. The permit which authorized construction of Jobes Dam lists recreation as its primary purpose. The Chain of Lakes offers diverse recreational opportunities for local residents and visitors year round, including fishing, waterfowl hunting, trapping, wildlife viewing, boating, and camping. Several traditional resorts and long-established businesses provide services for recreational activities, including restaurants, private campgrounds, boat and cabin rental, and bait shops. All services commonly found in a small city are available within walking distance from Elk and Duroy lakes.

Public boat access to the Chain is sufficient to accommodate the demand without crowding. Improved boat landings with concrete ramps, boarding piers, and parking for vehicles and trailers provide no-fee access to Elk Lake from County Highway H and to Wilson Lake from County Highway W. Additional boat access with fewer improvements is available from several town roads and private sites on all four lakes. Most recreational watercraft, including most pontoon boats, can navigate through the large culvert under Highway W that connects Wilson Creek Flowage and Long Lake.

Anglers can fish from shore at many sites on the Chain, including the fishing pier and river walkway on Elk Lake, the downtown frontage on Duroy Lake, all public boat landings, and road right-of-ways. The tailwaters also offer shorefishing opportunities, but that portion of the Elk River extending 500 feet downstream of Jobes Dam is a fish refuge where nobody may fish from April 15th to June 15th.

Aquatic Community Overview

Aquatic plants provide food and cover for many species and life stages of aquatic invertebrates and fish, especially young bluegill. Emergent and submergent plants also serve our interests by dampening wave action that might otherwise exacerbate shoreline erosion. We have made the following qualitative observations about aquatic plants in Duroy, Elk, and Long lakes:

- Duroy Lake
  - Aquatic plants are common around much of the shoreline.
  - Rooted plants grow to a maximum depth of 4½ feet.
  - Eurasian water milfoil, first reported in 2000, has become well established.
- Elk Lake
  - Aquatic plants are lacking around much of the shoreline.
  - Plant distribution is limited by steep drop-offs, coarse substrate, poor water clarity, and possibly contaminants in the sediment.
  - Aquatic plants occur only in two very small bays and the channel to Long Lake.
- Long Lake
  - Aquatic plants are sparse around much of shoreline.
  - Plant growth is limited by steep drop-offs, coarse substrate, and low water clarity.
  - Plant beds are dense in some shallow bays.

On September 14-15, 2007, WDNR performed a survey of the aquatic plant community in Wilson Lake (225 sites sampled) in order to document the status of invasive Eurasian water milfoil (first reported in 2002) and to provide information that might be useful in evaluating control options. Aquatic plants were common around much of shoreline and were dense in most areas with muck substrate. The percent relative frequency (frequency of occurrence divided by frequency of occurrence of all species, times 100) of Eurasian water milfoil was higher than any other plant species (25%), but desirable species such as coontail and elodea also were well represented (17% relative frequency for both species). The highest densities of Eurasian water milfoil in Wilson Lake were observed at depths of 3 to 6 feet where it clearly created a nuisance to navigation, though almost half the 29 sites sampled at depths of 7 to 8 feet in mucky substrate still had detectable Eurasian water milfoil.

In 2005 the Phillips Chain O'Lakes Association requested an over-winter drawdown to reduce the amount of Eurasian water milfoil (EWM) in the Chain. WDNR, working with lake association volunteers, found that EWM had declined substantially in all four lakes since 2002, so drawdown plans were placed on hold. We observed numerous milfoil weevils -- both adults and larvae -- feeding on EWM. Most surviving plants were heavily damaged and had few remaining leaves. Invasive, plant-eating rusty crayfish may have acted in concert with weevils to control EWM in the Phillips Chain more effectively than in other lakes. Unfortunately, density of EWM seems to have increased again in 2006 and 2007, prompting renewed interest in fall/winter drawdown as a potential EWM control method in 2008/2009 and periodically thereafter.

The benefits of a fall/winter drawdown to control Eurasian water milfoil in Wilson Lake must be balanced against the potential negative consequences, including the risks of inducing an oxygen-depletion fish kill and of upsetting the balance between predatory and prey fish. (Concentrating small, young fish into a much-reduced winter pool area could result in near loss of entire year classes of several fish species due to facilitated predation by large adult fish.) A lesser concern is the potential for greater harvest efficiency in a reduced pool area by ice anglers during drawdown years. However, if drawdowns are conducted for EWM control only once every five years or so, increased angler harvest during drawdown years should not compromise our ability to achieve fishery objectives. In addition to these ecological concerns, a planned drawdown in fall of 1996 was suspended because of complaints from several lakeside residents who experienced problems with malfunctioning wells and deteriorating water quality.

In spite of the physical limitations affecting plant growth in Elk and Long lakes (low water clarity, coarse substrate, and narrow littoral zone), we believe the areas of suitable habitat in this nutrient-rich ecosystem should support a plant community with greater diversity and higher density than has been observed in the past. Problems with aquatic plant growth may be related to contamination from a metal plating company that formerly discharged its wastewater into Elk Lake. Sediment samples taken from Elk Lake three decades ago had concentrations of chromium and copper exceeding levels lethally toxic to small, bottom-dwelling organisms called benthos. No remediation was required at that time because those metals did not accumulate in fish flesh. Some scientists speculate that levels of chromium and copper that are toxic to benthos might also inhibit aquatic plant growth. A recent analysis indicated that chromium and copper concentrations have decreased somewhat in the Phillips Chain, probably due to dilution by sediments deposited since the initial testing.

The poor condition of Eurasian water milfoil (EWM) in Elk Lake fuels our suspicion that past contamination by metals is suppressing plant growth in the lower reaches of the Phillips Chain. EWM is an invasive plant, which is normally so hardy and prolific that it quickly establishes dense stands and often displaces its native competitors. EWM has colonized substantial portions of Duroy and Wilson lakes upstream of the former discharge. In stark contrast, we observed only a few sparsely populated stands of EWM in Elk and Long lakes, and individual plants appeared withered and stunted.

We can characterize the fish community in the Phillips Chain from results of past surveys, many of which were conducted to assess walleye and muskellunge populations. Those samples, however, reveal little about the abundance and size distribution of panfish and black bass populations, two groups of sport fish that are important to local stakeholders (Table A1). Twenty-nine fish species have been captured in samples collected by electrofishing, fyke netting, and seining from 1962 to 2005. Diversity seems highest in Duroy Lake (25 species) and lowest in Elk and Long lakes (16 species). Species composition is similar to that in other regional waters where muskellunge, walleye, and black bass are the principal predators. Yellow perch, black crappies, and bluegills are the most abundant panfish.

Historical Perspective on the Fishery

In the absence of quantitative information from creel surveys, our observations and anglers' reports lead us to believe that the Phillips Chain receives low to moderate fishing pressure throughout the open water and ice covered periods. Ballpark estimates of 12 to 15 boats and 40 to 45 ice fishing shanties could be considered as reasonable approximations of typical daily angler use across the entire Chain. Wilson Lake receives the most ice fishing pressure, and Elk Lake receives virtually none.

Unlike some more popular waters where angling effort is often concentrated near the opening of the fishing season, on weekends and holidays, and during fishing tournaments, it appears that angling effort on the Phillips Chain remains relatively consistent. A minor increase in anglers might be noticed in June after the traditional opener of musky season. Recreational boating and other water sports usually peak on the July 4th holiday, but any influx of visiting anglers during holidays and tournaments seems to be offset by local anglers who stay home. There do not seem to be any significant conflicts among users.

In 2005 the Department granted permission for sponsors to hold two catch-and-release fishing tournaments on the Phillips Chain, in which 184 participants competed for $27,130 in prizes and registered 26 muskies, ranging from 32 to 44.5 inches long. An unknown number of fishing contests too small to require a permit -- most targeting muskellunge and black bass -- also take place on the Chain each year. As of 2008, fishing competitions involving fewer than 20 boats or 40 participants, or less than $500 in prize value, do not require Department approval.

Past management of the fishery in the Phillips Chain has focused primarily and consistently on walleye and muskellunge. Largemouth bass, smallmouth bass, northern pike, and panfish have been identified in various survey reports among the sportfish targeted for management in each lake; however, these species have received only sporadic attention. A broad range of fishery management tools have been used on the Phillips Chain since 1934, including assessment, stocking, habitat enhancement, and fishing regulations. Until now, however, no specific goals or performance measures have been formally established for the sportfish populations of greatest interest.

Most fish surveys assessed the relative abundance of various populations by comparing catch per unit of electrofishing or netting effort. Over the last 15 to 20 years, electrofishing catch rates from fall samples often were used to evaluate year-class strength of walleye fingerlings and yearlings as a projection of future walleye recruitment (survival to adulthood). In some surveys, an analysis of fish age (determined from annual marks on scales or bones) allowed comparison of growth rates with other fish populations throughout the State. In 1992 and 1997 estimates of adult muskellunge density in the Phillips Chain were derived from the ratio of fish marked and recaptured in successive years in all four lakes combined. Recapture of marked walleye and muskellunge also provided some insight about fish movement among the four lakes.

The earliest records indicate that fish stocking predates the construction of Jobes Dam; nearly 42,000 walleye fry were stocked into Elk Lake in 1933. Fish stocking into the Phillips Chain began in 1935 when the new impoundment was flooded. Each lake received walleye and muskellunge as fry or fingerlings between 1935 and 1962. A 1962 survey revealed that natural reproduction was sufficient to sustain a walleye fishery, and walleye stocking was suspended the following year. Annual plants of small walleye fingerling resumed in 1994 at a density of 50/acre, but stocking frequency decreased to alternate years in 2000. In a recent study of walleye fingerlings stocked in 23 northern Wisconsin lakes, average 3-month survival was 3.4%; and stocking increased the density of 3-month-old walleyes by only 0.13 fish/acre. High catch rates of fingerlings and yearlings in fall electrofishing surveys over the last 6 to 8 years in the Phillips Chain indicate that natural reproduction and survival through two summers of growth should support a walleye fishery without the minor supplementation expected from stocking small fingerlings. Consequently, walleye stocking was suspended again in 2005.

Between 1963 and 1993 muskellunge was the only gamefish stocked into the Phillips Chain. In that period each lake received muskellunge, often in two annual plants: first as small fingerlings in July, then again in fall as large fingerlings. Beginning in 1994, muskellunge stocking in the Phillips Chain generally occurred biennially at a rate of 0.5 or 1.0 large fingerling per acre. Presently, musky stocking continues in Duroy, Elk, and Long lakes at a rate of one large fingerling per acre in alternate years as part of a 10-year evaluation of musky stocking in northern Wisconsin.

Largemouth bass fingerlings, yearlings, and adults were initially planted in Duroy Lake in 1935 and 1939, and three of the four lakes received bass fingerlings once again in 1945. Other early fish stocking (1935 – 1938) in Duroy Lake included yearling and adult bluegill, black crappie, rock bass, and yellow perch. In 1971 adult bluegill and pumpkinseed were transplanted from five other populations into all four lakes of the Chain. However, an electrofishing evaluation in June 1973 revealed that the transfer did not increase panfish abundance in any of the lakes.

Permit records indicate that various structures were placed in the Phillips Chain to attract fish and improve angler success (Table 2). Details on the design of early brush shelters and fish cribs are unavailable. Tire cribs were built by stacking and fastening 6, 8, or 12 used automobile tires together to form a pyramid-shaped structure ranging in height from 2 to 6 feet. The fish cribs installed in 2005 had the traditional log cabin design—square in shape and filled with brush.

Table 2. Fish habitat structures installed in the Phillips Chain since 1964.

	Brush Shelters 1964	Fish Cribs 1964 – 1966	Tire Cribs 1988 – 1989	Log Cribs 2005
Duroy	7	--	11	--
Elk	5	--	6	--
Long	--	27	22	34
Wilson	--	2	14	--

With few exceptions fishing regulations in the Phillips Chain generally followed the statewide trends with respect to open seasons, bag limits, and size limits for inland waters. Among the most recent changes was an extension of the open season for largemouth bass, smallmouth bass, northern pike, and walleye. In 2005 the last day of the open season for those species changed from March 1 to the first Sunday in March.

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 that year 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 5 walleye per day on Duroy, Long, and Wilson lakes. As a courtesy service to anglers, the Department posts the daily limits at public boat landings on the Phillips Chain.

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. Presently, the only special fishing regulation on the Phillips Chain exempts walleye from the statewide 15-inch minimum length limit. This exemption was based partially upon the belief that density was high enough to cause lower-than-average growth rate and high natural mortality among males before they even attained 15 inches in length. It was based also upon the fact that mercury advisories were in effect for Solberg Lake and Musser Flowage – both upstream in the Phillips Chain watershed.

Reported incidents of extensive fish kills are rare on the Phillips Chain. On June 19, 1996 DNR Fisheries staff investigated a fish kill on Wilson Creek Flowage and found 700 – 1000 dead bluegill, black crappie, yellow perch, and pumpkinseed from 4 to 9 inches long. About two-thirds of the dead fish were bluegills. Many live panfish and no dead gamefish were observed, and several abandoned sunfish nests indicated that bluegill and pumpkinseed spawning was underway. The mortality event was characterized as a minor die-off restricted to panfish only. A combination of stresses associated with spawning, elevated water temperature (low 70s), and an intense green algae bloom was suggested as the probable cause. In late May and early June bluegill, crappie, yellow perch, and bullhead can be infected by and quickly succumb to columnaris, an aggressive bacteria that thrives when water temperature reaches 65 – 70°F and runoff from rainfall causes organic material to run into waterbodies.

A Vision for the Phillips Lake Chain Fishery

On March 18, 2005, DNR representatives Jeff Scheirer and Dave Neuswanger met with 24 local stakeholders who were willing to volunteer their time to help develop a long-term vision for the fisheries of Duroy, Elk, Long, and Wilson lakes – the Phillips Chain. 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 for species of greatest concern. Jeff Scheirer served as technical advisor to the group on what was possible. 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 the Phillips Chain to produce what is desired.

Detailed results of the visioning session appear in the Appendix. In summary, local stakeholders in the Phillips Chain fishery felt that these lakes were similar enough in character and connected to such an extent that they should be managed as a unit, with uniform goals, objectives, and strategies throughout the Chain. Though some noteworthy differences exist among these lakes, DNR representatives agreed that managing them as a unit should be possible except from a standpoint of regulating the minor level of tribal harvest that occurs, which traditionally has been monitored and regulated on a lake-by-lake basis. An analysis of walleyes and muskies captured, marked, and released in spring 1992, then recaptured in spring 1993 showed that adults of both species moved among the lakes in the Chain. These movements and the associated interactions that they imply bolster our confidence in managing the Chain's fishery as a unit with exceptions as necessary. Because of the importance of aquatic plants as habitat for fish and their food, the limitations affecting the plant community in Elk Lake and to a lesser degree in Long Lake, may warrant special strategies to accomplish goals and objectives for fish populations in those waters.

Similar to anglers statewide, local stakeholders were more interested in creating and sustaining good fishing for panfish, particularly black crappie and bluegill, than for any other species. Participants helped fill a gap in DNR data by informing us that the Phillips Chain has in times past produced more black crappies and bluegills of preferred and even memorable size than seem to exist today. Local stakeholders were almost unanimous in their stated preference for balance between numbers and sizes of panfish. And they were willing to forego maximum sustainable harvest if necessary to achieve that balance.

Local stakeholders ranked walleye high among fish species of interest in the Phillips Lake Chain. They were interested in maintaining a moderate density of walleye while improving existing size structure. An emphasis on walleye is consistent with statewide angler priorities and with maintaining desirable panfish populations, so efforts to achieve walleye population objectives will assume an important role in future management.

Smallmouth bass ranked almost as high as walleye among species of interest to local stakeholders. But in contrast with walleye, smallmouth bass were valued more for their size and sporting qualities, so there was a significant catch-and-release ethic toward smallmouth bass. According to local stakeholders, the goal and objectives chosen in this plan reflect current status of the smallmouth bass fishery in the Phillips Lake Chain. Folks wish to maintain this high-quality fishery.

Muskellunge were of moderate or high importance to two-thirds of local stakeholders. While participants exhibited a strong preference for catch-and-release musky fishing, most preferred a balance in the population between numbers and size. They were not interested in a strictly "numbers" fishery, nor were they interested in a strictly "trophy" fishery for muskellunge.

Yellow perch were of interest to many local stakeholders, but they were of distinctly less interest than the other panfish species – black crappie and bluegill. Nobody seemed to mind that, near the end of the meeting, we did not have time to discuss specific goals and objectives for yellow perch.

Largemouth bass were of some interest to local stakeholders, but that interest seemed to pale in comparison with interest in smallmouth bass. In light of these sentiments, smallmouth bass objectives will drive DNR strategies for managing black bass in this system.

Northern pike were of low or even negative interest to most local stakeholders despite their presumably moderate density in the Phillips Chain. Poor size structure and a perception that pike may compete with other species seemed to underlie these sentiments. Some resort owners and fishing guides held the easily-catchable northern pike in slightly higher regard, expressing their appreciation for the fishing action that keeps clients happy when other fish are not biting. No special measures will be taken to enhance density or size structure of northern pike.

A couple participants suggested that we give some consideration to channel catfish, but low or nonexistent interest among most other stakeholders suggests that our limited management dollars be spent elsewhere.

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.

THE PLAN

The following goals and objectives were developed with significant input from stakeholders in the fishery. We agree they are desirable and achievable. Stakeholders were not consulted about management strategies. Recommended strategies represent a local consensus agreement between Plan authors regarding actions necessary to achieve the goals and objectives

GOAL 1: **BLACK CRAPPIE:** A population of moderate density with a moderate proportion of preferred-size fish.

Objective 1.1: Currently we lack an agency-accepted standard method to assess the relative abundance of black crappie. Until such a method is developed, we will consider a late spring or mid fall fykenet capture rate of 10-20 black crappie 5 inches and longer per net-night to be indicative of the desired moderate density.

Objective 1.2: Of all black crappie 5 inches and longer captured by fyke netting in late spring or mid fall, 30-40% should be 10 inches or longer (RSD_{10} = 30-40%).

Black Crappie Status and Management Strategies (Local DNR Recommendations):

Past sampling of black crappie in the Phillips Chain has involved spring or fall electrofishing or mid-summer fyke netting, usually incidental to surveys targeting other fish species. We consider those methods unreliable for purposes of characterizing relative abundance or size structure of crappie, so meaningful historical data are lacking. During October 9-11, 2007 we expended 18 net-nights of effort in the first attempt to characterize the crappie population of the Phillips Chain by fall fyke netting – a standard method of assessment in several states. Capture rate of 5-inch and larger fish (hereinafter referred to as stock-size fish) ranged from a very low 1.0 per net-night in Elk Lake to 6.6 per net-night in Wilson Lake, averaging only 4.0 per net-night throughout the Chain (Table 3). This seems to indicate a density that is well below the tentative desired range of 10-20 stock-size crappies per net-night; but until we have more experience with this method of assessment in Upper Chippewa Basin lakes, we cannot make conclusive statements.

One indicator that crappie density may, in fact, be quite low is that we captured very few crappies between 4.0 and 8.5 inches long in fall 2007 fyke nets. Fish of this size would have appeared in the nets if present, along with the predominant size group at 8-10 inches (PSD = 89% and RSD_{10} = 15%; Table 3). This gap in the length-frequency distribution represents very weak 2005 and 2006 year classes (verified by age analysis). Sporadic crappie recruitment is not unusual in fish communities dominated by walleye populations of moderate to high density. A moderate capture rate of 2.8 young-of-year black crappie per net-night averaging 3.6 inches long confirms that our nets sampled even small fish and that a 2007 year class was present. We do not know how many of those small crappie will survive to adulthood after one more year at sizes vulnerable to predation by abundant walleye.

Fast growth rate can be an indirect indicator of low density (low competition for food) in crappie populations. Scale analysis reveals that most fish captured in fall 2007 fyke nets were 8.3- to 9.5-inch members of the 2004 year class that had just completed their fourth full growing season – averaging 9.1 inches (N = 26) and exceeding the statewide average for age-4 black crappie by 0.5 inch. Phillips Chain crappie averaged 3.6 (N = 20), 6.5 (N = 7), and 8.4 (N = 3) inches long at the end of 1, 2, and 3 full growing seasons, respectively – also higher than statewide averages of 3.1, 5.4, and 7.2 inches for fish at ages 1 through 3. Phillips Chain crappie were almost 10 inches long by the end of their fifth growing season (9.8 inches; N = 8).

Table 3. Catch rates and size structure indexes of black crappie captured in fall 2007 fyke nets in the Phillips Lake Chain. PSD, RSD_{10}, and RSD_{12} are proportions of all crappie ≥ 5 inches that were 8, 10, and 12 inches or longer, respectively.

Lake	Dates	Net-nights	Number ≥ 5" captured per net overnight	PSD (%)	RSD_{10} (%)	RSD_{12} (%)
Duroy	October 9	5	1.8	100	22	0
Elk	October 9	3	1.0	100	0	0
Long	October 10	5	5.4	93	4	0
Wilson	October 11	5	6.6	82	24	9
Chain Summary	October 9-11	18	4.0	89	15	4

DNR has never conducted a creel survey that would allow us to estimate angler harvest of black crappie on the Phillips Chain, but we suspect that anglers take a substantial portion of the population over 8 or 9 inches long when available. Our belief is based on local reports of good fishing, observations of moderate but consistent fishing pressure on Duroy and Wilson lakes, and angler preference, both locally and statewide, to catch and keep crappies. In our opinion, 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. We believe the low RSD_{10} in our fall 2007 fyke net sample is symptomatic of anglers selectively harvesting a high proportion of the largest crappies in the population. Consequently, some combination of reduced daily bag limit and minimum length limit may be necessary in order to achieve desired crappie population density and size structure.

A bag limit reduction by itself could increase numbers of crappie without improving size structure. A minimum length limit in combination with a reduced daily bag limit seems like a viable option for the Phillips Chain because of sporadic recruitment and fast growth rate, provided 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. If Phillips Chain crappie continue to recruit sporadically and to attain an average length of approximately 10 inches by the end of their fifth growing season, a 10-inch minimum length limit combined with a 10-daily bag limit (similar to the Turtle-Flambeau Flowage) may allow us to achieve Objectives 1.1 and 1.2. Such a regulation 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 and spring 2014.

Crappie anglers always ask about fish cribs. Adding more fish cribs in the Phillips Chain is not considered necessary or desirable at his 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 2: **BLUEGILL:** A population of moderate density with a low to moderate proportion of preferred-size fish.

Objective 2.1: Currently we lack an agency-accepted standard method to assess the relative abundance of bluegill. We will initiate a new baseline monitoring protocol in 2008 by establishing late-spring electrofishing index stations in and around spawning areas in order to begin tracking the relative abundance of bluegill. Until we have reliable data upon which to base an objective, we will consider a late spring electrofishing capture rate of 50-100 bluegill 3 inches and longer per hour to be somewhat indicative of the desired moderate density.

Objective 2.2: Of all bluegill 3 inches and longer (stock size) captured by fyke netting in late spring or mid fall, or by electrofishing while bluegill are spawning, 5-10% should be 8 inches or longer (RSD_8 = 5-10%).

Bluegill Status and Management Strategies (Local DNR Recommendations):

The local bait shop owner believed that anglers typically fished for bluegill from ice-out through the bluegill spawning period and that few anglers targeted bluegills at other times because bluegill fishing on the Phillips Chain has never been exceptional. While it is understandable that anglers' attitude, behavior, and success are influenced by the existing condition of the fishery, stakeholders were asked to develop their vision for the desired fishery independent of its current state. Bluegill were second only to black crappie among the species of angling interest for participants at the 3/18/05 visioning session (Table A1).

To date, we have collected very limited data useful in evaluating the status of bluegill in the Phillips Chain. Pre-spawn electrofishing in Duroy and Wilson lakes in May of 2000 and 2002, respectively, suggests that bluegill are capable of achieving lengths exceeding 8 inches in the Phillips Chain, but that RSD_8 may have been lower than desired (Table 4).

Table 4. Catch rates and size structure of bluegill captured by early spring electrofishing. RSD_8 is the proportion of all bluegill ≥ 3 inches that were 8 inches or longer.

Lake	Date	Water Temperature (°F)	Electrofishing Effort (Hours)	Number ≥ 3" captured per hour electrofishing	RSD_8 (%)
Duroy	May 8, 2000	68	1.8	83	2
Wilson	May 21, 2002	57	0.7	147	1

We also examined fyke net data collected in mid summer from 2000 to 2002 to get some idea of bluegill population size structure. We do not know how to interpret mid-summer fyke net catch rates or size structure indices for bluegill, but again we captured at least a few fish over 8 inches long (Table 5). This provides more evidence that Objective 2.2 is not unattainable in this productive system, even though we lack information on growth rate at this time. Because large adult bluegill generally inhabit open-water areas during mid summer, we will not count on mid-summer fyke netting (which samples mostly smaller, inshore fish) to index the relative proportion of preferred-size blueill (≥8 inches) in the population. Instead, we will use late spring electrofishing to characterize bluegill population abundance and size structure in order to track status and progress toward meeting Objective 2.2.

Table 5. Catch rates and size structure of bluegill captured in large fyke nets in mid summer. RSD_8 is the proportion of all bluegill ≥ 3 inches that were 8 inches or longer.

Lake	Dates	Net-nights	Number ≥ 3" captured per net overnight	RSD_8 (%)
Duroy	Jul-31 to Aug-02-2000	4	12	2
Elk	Jul-09 to Jul-12-2001	12	4	4
Wilson	Jul-29 to Aug-01-2002	12	19	3

In our opinion, it is unlikely that we will achieve the bluegill size structure objective (2.2) under current regulations that permit anglers to harvest 25 panfish daily of any species with no minimum length limit. If existing data accurately reflect current status, we may one day conclude that anglers have been selectively harvesting an excessive proportion of the largest bluegill in the population. Targeted monitoring of the bluegill population, including growth rate analysis, is scheduled to occur with late spring electrofishing in 2008. If RSD_8 is still below target and bluegill growth rate is average or better, we will likely recommend a reduced daily bag limit in time to evaluate its initial impact during the next baseline monitoring survey scheduled for spring 2014.

We are not optimistic that expectations for bluegill abundance can be met throughout the Phillips Chain if something is not done to increase near-shore cover in Elk and Long lakes, where rooted plant growth currently is very sparse. In the near absence of littoral zone cover, young bluegill will remain quite vulnerable to predation by abundant walleye throughout the year in Elk and Long lakes, possibly keeping bluegill density lower than desired. Documenting the real limiting factors to macrophyte growth (metals in Elk Lake sediments?) and establishing desirable plant species (if possible) or adding woody cover (e.g., tree drops) near shore will be needed in order to maximize the chances of achieving bluegill population objectives in Elk and Long lakes.

GOAL 3: **WALLEYE:** A population of moderate density with a moderate proportion of quality-size fish.

Objective 3.1: 3 to 5 adult walleye per acre in spring population estimates, or early spring fyke-netting capture rates that we someday determine to be statistically associated with the desired density. (Adult walleye are defined by DNR as all fish over 15 inches long and all smaller fish for which gender can be determined in early spring.)

Objective 3.2: Of all walleye 10 inches and longer (stock size) captured by fyke netting in early spring, 20-40% should be 15 inches or longer (PSD = 20-40%).

Walleye Status and Management Strategies (Local DNR Recommendations):

The most recent early spring fyke netting survey in the Phillips Chain occurred more than a decade ago. That effort targeted muskellunge, which usually spawn in different locations than walleye a week or two after the walleye spawning season. During April 23 – May 2, 1997, DNR crews captured only 115 stock-size and larger walleye in 74 net-nights of effort (only 1.6 per net-night). Size structure was highly variable among the four lakes (PSD ranged 12 – 84% and averaged 47%). Low capture rates and highly variable size structure reflects the musky-biased net locations and post-spawn timing, rendering the 1997 netting survey of limited value for walleye.

Slightly more useful walleye data were obtained in a series of successive early spring electrofishing surveys on lakes of the Phillips Chain from 2000 through 2003. Electrofishing catch rate (an index of relative abundance) for walleye 10 inches and longer was reasonably consistent among the four lakes in the Phillips Chain, ranging from 31 to 57 per hour and averaging 43 per hour among the four lakes over a four-year time period (Table 6). Proportional Stock Density (PSD) averaged 25%, indicating that a substantial proportion of walleye survive until they are at least 15 inches long despite the absence of a minimum length limit. However, PSD varied greatly among the lakes in these successive annual surveys, causing us to question electrofishing as a method for monitoring walleye stocks within the Chain. Higher PSD and RSD_{20} values for the shallowest, weediest lakes (Duroy and Wilson) lead us to believe that lake basin morphometry and littoral zone cover may have biased past electrofishing results. Therefore, we believe future baseline monitoring of the adult walleye population should occur by using fykenets in early spring where walleyes are congregating to spawn. The next such survey is scheduled for spring of 2008.

Table 6. Catch rates and size structure of walleye captured in the most recent early spring electrofishing surveys conducted on lakes of the Phillips Chain. PSD and RSD_{20} are the proportions of all walleye ≥10 inches that were 15 and 20 inches or longer, respectively.

Lake	Date	Water Temperature (°F)	Electrofishing Effort (Hours)	Number ≥10" captured per hour of electrofishing	PSD (%)	RSD_{20} (%)
Duroy	Apr-24-2000	53	1.7	57	35	5
Elk	Apr-21-2001	44	1.6	38	18	0
Wilson	Apr-28-2002	45	2.4	31	40	5
Long	Apr-28-2003	52	1.9	51	8	0
Phillips Chain Summary	2000 - 2003	44 - 53	7.6	43	25	3

Information from fall electrofishing surveys designed to evaluate the reproductive success of walleye provides convincing evidence that walleye populations throughout the Phillips Chain are capable of sustaining themselves naturally. Excluding the highest and lowest values, capture rates for age-0 walleye in the Phillips Chain averaged 135 per hour (ranged 31 to 394 per hour) in 20 fall electrofishing surveys completed by Department staff from 1992 to 2005. By comparison, capture rate of age-0 walleye averaged 99 per hour in fall recruitment surveys (1990 to 2004) on all Price County lakes classified as having self-sustaining walleye populations.

The observed annual variability in walleye reproduction should have little bearing on attainment of objectives for population density and size structure. Walleye growth rate varies greatly between sexes and among individuals. The adult portion of the population desirable to anglers consists of many age classes, so density does not rely on the strength of any single year class. Because natural reproduction has been above average in the Phillips Lake Chain, we are confident in our decision to discontinue supplemental stocking in 2005. As long as natural reproduction remains satisfactory, we see no need to stock walleye in the Phillips Chain. In our opinion, stocking walleye anytime in the near future would be counter-productive and should be discouraged, because stocked fish may lack the local genetic adaptations that allow walleye to reproduce successfully in most years.

Currently, walleye in the Phillips Chain are exempted from the 15-inch minimum length limit, presumably to avoid "stockpiling" walleye thought to be growing so slowly that a high proportion (particularly of males) could die naturally before attaining legal length. Since 2005, anglers have reported catching more plump 15- to 17-inch walleyes than in preceding years; but we must await a fyke netting survey in spring of 2008 in order to know if Objective 3.2 currently is being met. In the absence of a minimum length limit, selective harvest of the fastest-growing and largest fish could certainly depress walleye population size structure. If future survey results validate such concerns, then more restrictive harvest regulations may be necessary to achieve objectives for walleye density and size structure. Two available regulatory options that would protect some quality-size fish while continuing to allow harvest of abundant small walleye are the "14- to 18-inch protected slot length limit" and the "one-over-14-inch daily bag limit" (allowing 2-5 daily, only 1 of which may be over 14 inches long). The latter seems more consistent with a local stakeholder preference to maintain balance between harvesting and releasing walleye (Table A2), but biological factors such as growth rate will influence future recommendations as well.

GOAL 4: **SMALLMOUTH BASS:** A population of moderate density with a high proportion of preferred-size fish and a moderate proportion of memorable-size fish.

Objective 4.1: Electrofishing capture rates for 7-inch and longer smallmouth bass of 25-50 per hour in bass spawning grounds during the bass spawning season.

Objective 4.2: Of all smallmouth bass 7 inches and longer captured by electrofishing during the bass spawning season, 50-70% should be 14 inches or longer (RSD_{14} = 50-70%) and 10-20% should be 17 inches or longer (RSD_{17} = 10-20%).

Smallmouth Bass Status and Management Strategies (Local DNR Recommendations):

Participants in the March 2005 visioning session believed that the goal and objectives of this plan reasonably describe the current status of the smallmouth bass population in the Phillips Chain. Electrofishing catch rates and size structure indices were highly variable and largely unreliable in the fall and early spring electrofishing surveys conducted during 1995-2005 (Table 7). We cannot confirm that objectives are being met until we conduct meaningful surveys during the late spring spawning period when bass of all sizes become consistently vulnerable to capture by electrofishing in shallow water. Such surveys are scheduled for spring of 2008 and every six years thereafter. Despite our inability to accurately characterize recent bass population density and size structure, fall and early spring electrofishing data from 1995 to 2005 have demonstrated convincingly that smallmouth bass are the predominant species of black bass in the Phillips Chain. Largemouth bass have been scarce or nonexistent in the Chain with the exception of Wilson Lake, where they were captured at a low rate of 9/hour on 5/21/02. Predictably, smallmouth bass have been rare in the shallow, weedy environs of Wilson Lake.

Unless upcoming survey results conflict with positive angler opinions about the current smallmouth bass fishery, it appears that no special management actions will be necessary. But we reserve the right to recommend more appropriate length limits if meaningful surveys reveal that objectives are not being met due to insufficient recruitment or size-selective over-harvest of legal-size smallmouth bass (over 14 inches long). Addition of tree drops, preferably using whole trees of various species that are imported from an upland site, could partially offset the loss of smallmouth bass spawning and nursery habitat in Elk Lake where tree removal along the river walkway will disrupt the natural input of complex woody structure into the littoral zone there.

Table 7. Catch rates and size structure of smallmouth bass captured by electrofishing in smallmouth waters of the Phillips Chain, 1995-2005. RSD_{14} and RSD_{17} are the proportions of all smallmouth bass ≥7 inches that were 14 and 17 inches or longer, respectively.

Lake	Date	Water Temp. (°F)	Electrofishing Effort (Hours)	Number ≥7" captured per hour of electrofishing	RSD_{14} (%)	RSD_{17} (%)
Duroy	Sep-10-1996	63	0.8	18	29	0
	Apr-24-2000	53	1.7	16	52	7
	May-08-2000	68	1.8	11	16	0
	Sep-21-2000	58	1.7	9	20	7
Elk	Sep-10-1996	70	0.8	11	0	0
	Apr-21-2001	44	1.6	2	33	0
	May-15-2001	59	1.3	22	7	0
	Sep-17-2001	62	1.4	12	6	0
	Sep-27-2005	63	1.2	9	18	0
Long	Sep-12-1995	66	1.3	6	0	0
	Sep-12-1996	64	1.2	5	0	0
	Sep-09-1997	66	1.4	3	0	0
	Sep-09-1999	66	1.3	3	0	0
	Apr-28-2003	52	1.9	5	11	0

GOAL 5: **MUSKELLUNGE:** A muskellunge population of moderate density with a moderate proportion of memorable-size fish.

Objective 5.1: 0.2 to 0.3 adult muskellunge per acre in population estimates, or early spring fyke-netting capture rates that we someday determine to be statistically associated with the desired density. (Adult muskellunge are defined by DNR as all fish over 30 inches long and all smaller fish whose gender can be determined, either by expressing gametes or by examining dimorphic characteristics of the vent.)

Objective 5.2: Of all muskellunge 20 inches and longer captured by fyke netting in early spring, 15-30% should be 42 inches or longer (RSD_{42} = 15-30%).

Muskellunge Status and Management Strategies (Local DNR Recommendations):

We lack current information on muskellunge in the Phillips Chain, but data from 1992-93 and 1997-98 provide some insight into our ability to meet newly established objectives for population density and size structure. Based on estimates derived from marked muskellunge captured by fyke netting in successive years, adult population density for the Phillips Chain was near the lower end of the desired range in 1992 and 1997 (Table 8). The proportion of memorable-size fish (RSD_{42}) consistently fell short of our objective in all four spring fyke netting samples in the 1990s.

Given the impression that density was somewhat lower than desired in the late 1990s, DNR resumed stocking large fingerlings in 1999, then doubled the traditional stocking rates in 2003. Currently we stock large muskellunge fingerlings (10 to 12 inches) at a rate of one per acre in alternate years in order to supplement recruitment from natural reproduction. This protocol will be followed in Duroy, Elk, and Long lakes until at least 2012 as part of a statewide evaluation of the contribution of stocked muskellunge in waters with some natural reproduction. Study results should help us determine whether stocking is necessary, and if so, what stocking rate and frequency are appropriate to sustain population density at 0.2 to 0.3 adult per acre.

Table 8. Estimated adult density and size structure of muskellunge captured by fyke netting in the Phillips Chain during the 1990s. Proportional Stock Density (PSD) and Relative Stock Density (RSD_{38} and RSD_{42}) are the proportions of all muskellunge ≥20" that were 30, 38, and 42 inches or longer, respectively.

Date	Number Captured ≥20"	Estimated number of adults ≥30" per acre	PSD (%)	RSD_{38} (%)	RSD_{42} (%)
Spring 1992	49	0.15	90	14	4
Spring 1993	113	---	76	26	9
Spring 1997	112	0.20	61	20	8
Spring 1998	96	---	78	23	5

We have very little reliable information about growth rate of muskellunge in the Phillips Chain. Counting rings on scales is now known to significantly underestimate the age of known-age fish. A small sample of muskellunge sacrificed for the sake of accurate age analysis (requiring cleithrum bone removal) in 1998 revealed the expected high degree of variability in growth rate between the sexes and among individual fish of the same gender. At time of capture, three female muskellunge were: 33.5" at age 6, 30.5" at age 7, and 34.5" at age 12 (an unusually slow-growing female). Five males were: 28.8" at age 6, 32.8" at age 9, 30.3" and 38.3" at age 11, and 38.8" at age 13. The population was comprised of many age classes, allowing us to conclude that the fishery is not critically dependent upon consistent natural recruitment or annual stocking. RSD_{42} values between 4 and 9 percent assure us that the Phillips Chain has the potential to produce muskellunge 42 inches and longer (Table 8) given sufficient time to reach such memorable size. In August of 1991 an angler caught a muskellunge measuring 48 inches long and weighing 30 pounds while crappie fishing in Long Lake.

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 harvested in the Phillips Chain or elsewhere. However, recent WDNR research indicates that use of 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 anglers on the Phillips Chain; but we are certain that successful live release is essential in order to establish and maintain the desired fishery (Objectives 5.1 and 5.2). WDNR will have a question on the Spring Hearing Questionnaire of the Wisconsin Conservation Congress in March of 2008 that would make the use of single-hook sucker rigs illegal, requiring live bait anglers to use "quick-set" rigs instead. We encourage local stakeholders with an interest in the musky fishery to attend the 2008 spring hearings and voice their support for this proposal.

Management agencies commonly use high minimum length limits for muskellunge to achieve the goals for the fishery, but few evaluations of length-limit effects on muskellunge populations have been completed. Researchers evaluated the effects of a 40-inch minimum length limit on seven northern Wisconsin lakes and compared the results to eight lakes that remained at the statewide minimum length limit of 32 or 34 inches. Five years after its implementation, the 40-inch minimum length limit did not increase adult muskellunge abundance or size structure compared with reference lakes. At this time, we see no need to depart from the statewide 34-inch minimum length limit for muskellunge on the Phillips Chain. However, if fyke netting surveys in early spring of 2008 and beyond reveal that Objective 5.2 is not being achieved, we reserve the right to consider and propose a slot length limit that would protect larger fish than are protected now while allowing some small, old, slow-growing fish to be culled from the population.

We recommend further that the Phillips Chain O'Lakes Association actively attempt through distribution by newsletter, posters, and brochures to provide anglers with information on musky angling and handling techniques that minimize delayed mortality of released muskellunge. The lake association and other local partners can also help by coordinating and encouraging participation in a volunteer musky angler diary program, which would aid our evaluation of musky angling success and harvest.

GOAL 6: **BIODIVERSITY:** 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 native aquatic species in the lakes or their connecting channels; and no catastrophic losses to disease or poor water quality that could lead to fish community imbalance and failure to achieve important sport fishing objectives.

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

General Ecosystem Management Strategies (Local DNR Recommendations):

Introduction of invasive species should be discouraged by the Phillips Chain O'Lakes Association via their newsletter and appropriate signing at resorts and public access areas. To monitor trends in abundance and distribution of exotic plants that have already become established, DNR's Upper Chippewa Basin Water Resources Biologist will continue to rely upon help from lake association volunteers.

Support for good shoreland management would serve to prevent high nutrient levels from increasing further to a point where nuisance algae blooms become commonplace. Diligence in maintaining wild shorelines and wide buffer strips between managed lawns and the lake will be rewarded with the quality fishery envisioned in this plan. Minimizing the input of phosphorus and nitrogen from lawns or faulty septic systems will minimize 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. But the more undeveloped shoreland that can be restored or maintained in a natural state, the greater the likelihood that Phillips Chain will remain a special place for our children's children.

A diverse and stable forage base comprised of suitable-size prey is vital to maintain sport fish populations with acceptable growth rate and size structure. Maintaining healthy native plant communities will be important in facilitating and regulating the recruitment and production of young bluegill, yellow perch, crayfish, and other organisms consumed by predatory sport fish. We refer readers to the Aquatic Community Overview section of this plan to review the current status of aquatic plant communities and use what we know to advocate for the healthiest possible ecosystem. We urge extreme caution if lakeside landowners decide they can no longer tolerate the infestation of Eurasian water milfoil (EWM) in Wilson Lake and feel that fall/winter drawdown is the only practical means of control. A drawdown of 5 feet might temporarily kill most EWM in the system, but such a drawdown would reduce the pool area of Wilson Lake by 47%, causing crowded conditions among over-wintering fish and increasing the risk of an oxygen-depletion fish kill in some areas, especially if inflow should fall below anticipated levels. At the very least, emergency aeration systems should be installed and used to maintain suitable water quality conditions during the ice-cover period, with frequent monitoring of dissolved oxygen levels throughout the winter to determine the effectiveness of aeration throughout the Chain. Baseline monitoring of fish populations at approximately six-year intervals should tell us whether any fall/winter drawdowns are having a negative impact on the fishery.

Phillips Lake Chain Fishery Management Plan
February 2008
Summary of Local DNR Strategies & Recommendations
(Proposed roles for partners are underlined.)

Black Crappie: We will continue to monitor black crappie populations by fall fykenetting approximately every six years. If Phillips Chain crappie continue to recruit sporadically and to attain an average length of approximately 10 inches by the end of their fifth growing season, a 10-inch minimum length limit combined with a 10-daily bag limit (similar to the Turtle-Flambeau Flowage) may allow us to achieve crappie objectives. Such a regulation 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 and spring 2014. Adding more fish cribs in the Phillips Chain is not considered necessary or desirable at his time.

Bluegill: We will use late spring electrofishing to characterize bluegill population abundance and size structure in order to track status and progress toward meeting bluegill objectives. If RSD_8 is still below target and bluegill growth rate is average or better, we will likely recommend a reduced daily bag limit in time to evaluate its initial impact during the next baseline monitoring survey scheduled for spring 2014. Documenting the real limiting factors to macrophyte growth (metals in Elk Lake sediments?) and establishing desirable plant species (if possible) or adding woody cover (e.g., tree drops) near shore will be needed in order to maximize the chances of achieving bluegill population objectives in Elk and Long lakes.

Walleye: We believe future baseline monitoring of the adult walleye population should occur by using fykenets in early spring where walleyes are congregating to spawn. The next such survey is scheduled for spring of 2008. Stocking walleye anytime in the near future would be counter-productive and should be discouraged, because stocked fish may lack the local genetic adaptations that allow walleye to reproduce successfully in most years. If future survey results validate concerns about potential over-harvest of quality-size walleye, then more restrictive harvest regulations may be necessary to achieve objectives for walleye density and size structure. Two available regulatory options that would protect some quality-size fish while continuing to allow harvest of abundant small walleye are the "14- to 18-inch protected slot length limit" and the "one-over-14-inch daily bag limit" (allowing 2-5 daily, only 1 of which may be over 14 inches long). The latter seems more consistent with a local stakeholder preference to maintain balance between harvesting and releasing walleye, but biological factors such as growth rate will influence future recommendations as well.

Smallmouth Bass: We cannot confirm that objectives are being met until we conduct meaningful surveys during the late spring spawning period when bass of all sizes become consistently vulnerable to capture by electrofishing in shallow water. Such surveys are scheduled for spring of 2008 and every six years thereafter. Addition of tree drops, preferably using whole trees of various species that are imported from an upland site, could partially offset the loss of smallmouth bass spawning and nursery habitat in Elk Lake where tree removal along the river walkway will disrupt the natural input of complex woody structure into the littoral zone there.

Muskellunge: Currently we stock large muskellunge fingerlings (10 to 12 inches) at a rate of one per acre in alternate years in order to supplement recruitment from natural reproduction. This protocol will be followed in Duroy, Elk, and Long lakes until at least 2012 as part of a statewide evaluation of the contribution of stocked muskellunge in waters with some natural reproduction. WDNR will have a question on the Spring Hearing Questionnaire of the Wisconsin Conservation Congress in March of 2008 that would make the use of single-hook sucker rigs illegal, requiring live bait anglers to use "quick-set" rigs instead. We encourage local stakeholders with an interest in the musky fishery to attend the 2008 spring hearings and voice their support for this proposal. At this time, we see no need to depart from the statewide 34-inch minimum length limit for muskellunge on the Phillips Chain. However, if fyke netting surveys in early spring of 2008 and beyond reveal that Objective 5.2 is not being achieved, we reserve the right to consider and propose a slot length limit that would protect larger fish than are protected now while allowing some small, old, slow-growing fish to be culled from the population. We recommend that the Phillips Chain O'Lakes Association actively attempt through distribution by newsletter, posters, and brochures to provide anglers with information on musky angling and handling techniques that minimize delayed mortality of released muskellunge. The lake association and other local partners can also help by coordinating and encouraging participation in a volunteer musky angler diary program, which would aid our evaluation of musky angling success and harvest.

General Ecosystem Management: Introduction of invasive species should be discouraged by the Phillips Chain O'Lakes Association via their newsletter and appropriate signing at resorts and public access areas. Support for good shoreland management would serve to prevent high nutrient levels from increasing further to a point where nuisance algae blooms become commonplace.

We urge extreme caution if lakeside landowners decide they can no longer tolerate the infestation of Eurasian water milfoil (EWM) in Wilson Lake and feel that fall/winter drawdown is the only practical means of control. A drawdown of 5 feet might temporarily kill most EWM in the system, but such a drawdown would reduce the pool area of Wilson Lake by 47%, causing crowded conditions among over-wintering fish and increasing the risk of an oxygen-depletion fish kill in some areas, especially if inflow should fall below anticipated levels. At the very least, emergency aeration systems should be installed and used to maintain suitable water quality conditions during the ice-cover period, with frequent monitoring of dissolved oxygen levels throughout the winter to determine the effectiveness of aeration throughout the Chain.

APPENDIX

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

Date: March 18, 2005
Time: 6:00 p.m. to 9:45 p.m.
Place: Phillips High School Auditorium in Phillips, Wisconsin
Facilitator: Dave Neuswanger, Fisheries Supervisor, Upper Chippewa Basin, WDNR
Technical Advisor: Jeff Scheirer, Senior Fisheries Biologist, Price/Rusk/Taylor counties, WDNR
Profile of 21 Participants (more than one affiliation possible per person):

Lakeside Landowners – 13
Area Anglers – 11
Fishing Guides – 1
Business Owners – 4
Members of other lake associations in the area – 3

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

Fish Species Nominated	Level of Participant Fishing Interest			
	High	Medium	Low	None
Black Crappie	13	10	0	0
Bluegill	12	6	6	0
Walleye	12	5	4	0
Smallmouth Bass	10	9	6	0
Muskellunge	12	4	6	2
Yellow Perch	6	8	8	0
Largemouth Bass	4	13	5	2
Northern Pike	0	1	18	3
Channel Catfish	0	2	10	10

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

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
Black Crappie	2	18	1	0	18	2
Bluegill	3	16	2	0	18	2
Walleye	0	18	2	3	17	0
Smallmouth Bass	0	12	9	16	4	0
Muskellunge	1	8	7	14	0	1