A 10-YEAR STRATEGIC PLAN FOR MANAGING WISCONSIN'S PANFISH

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Contents

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<u>Acknowledgement</u>

An impressive number of Department staff, current and retired, and anglers contributed to various stages of the development of this plan. For decades Department staff have researched and managed panfish, laying the groundwork for guidance and developing institutional knowledge. Past Panfish Team Leaders initiated this process and made huge strides in moving panfish management forward, specifically Doug Beard, Nancy Nate, Andy Fayram, and Joanna Griffin. Joanna Griffin is owed substantial credit for leading the team through a multi-year public input process outlining the original plan. Past members of the Panfish Team contributed heavily to the literature reviews and ultimately the content of the plan, in particular Dave Neuswanger. Finally, we owe a huge thank you to all the anglers and general public who took the time to provide input through writing, attending meetings, voting at the spring hearings, or simply picking up the phone. Your input is central to everything we do and we constantly strive to strike an appropriate balance that provides an enjoyable and sustainable fishing opportunity.

Executive Summary

Panfish (e.g. bluegill, pumpkinseed, crappies, yellow perch) are an exceptionally popular group of fish to Wisconsin anglers and are valued primarily for harvest. Despite their popularity and importance there is no existing panfish management plan for Wisconsin. This document fills that critical gap as the strategic plan for managing Wisconsin's panfish for the next decade. The plan is strategic in nature and provides the direction for the Bureau of Fisheries Management program. Specifically, broad goals are identified and associated objectives listed by topic. Objectives are further clarified by identifying strategies and specific actions.

Relevant background information was gleaned from an exhaustive literature review and a status and trends analysis using Wisconsin survey data. Negative trends observed in panfish size structure over the last 50 years are concerning. Clarification in monitoring protocols and the assessment program is needed but according to current data, some proposed goals are being met while others are not.

The diverse nature of panfish and their varying life histories, particularly across the multitude of lake types dotting Wisconsin's landscape, provide ample management challenges. Recruitment is central to balancing abundance and preventing poor growth in all panfish species, but successfully manipulating recruitment is challenging. Managing angler harvest is key to providing quality bluegill size structure in most systems yet striking a regulatory balance between biology and social desires is highly controversial. An adaptive management approach has been initiated to address this information need.

From a broad, long-term perspective, habitat protection and enhancement are a critical component of panfish management; focusing in this realm as a long-term priority is widely supported by the public and will increase resiliency of panfish populations to future disturbances and threats..

Short-term focus should be directed towards specifying guidance on assessment, including specific monitoring protocols, lakes classification, and setting associated population parameter goals. Additionally, we need to better understand panfish angler preferences and motivations – they make up a large share of fishing license buyers in Wisconsin, but are often under-represented in management planning. Moreover, numerous management misconceptions exist. Thus, successfully engaging panfish anglers in Wisconsin is paramount to future management success and achieving objectives related to habitat, harvest regulations, and outreach.

Introduction

In Wisconsin, the group of fish referred to as "panfish" are comprised of black crappie (*Pomoxis nigromaculatus*), bluegill (*Lepomis macrochirus*), green sunfish (*Lepomis cyanellus*), orangespotted sunfish (*Lepomis humilis*), pumpkinseed (*Lepomis gibbosus*), warmouth (*Lepomis gulosus*), white crappie (*Pomoxis annularis*), and yellow perch (*Perca flavescens*). Bluegill, black crappie, and yellow perch are the most widespread and commonly known species of panfish. The term "sunfish" is often used in reference to panfish and collectively includes bluegill and pumpkinseed. Detailed information on identification, distribution, and life history of the various panfish species in Wisconsin is available from Becker (1983), on-line (http://www.seagrant.wisc.edu/home/Default.aspx?tabid=604); Lyons 2011), or in WDNR literature reviews (Fayram et al. 2012; Niebur et al. 2012; Neuswanger et al., 2016).

Panfish are arguably the most important group of fish for anglers fishing Wisconsin's inland waters. According to a 2014-2015 statewide mail survey, anglers targeted panfish on 27% of their fishing trips, more than any other species or group of fish (Figure 1). It's clear that panfish are the backbone of Wisconsin's inland fisheries.

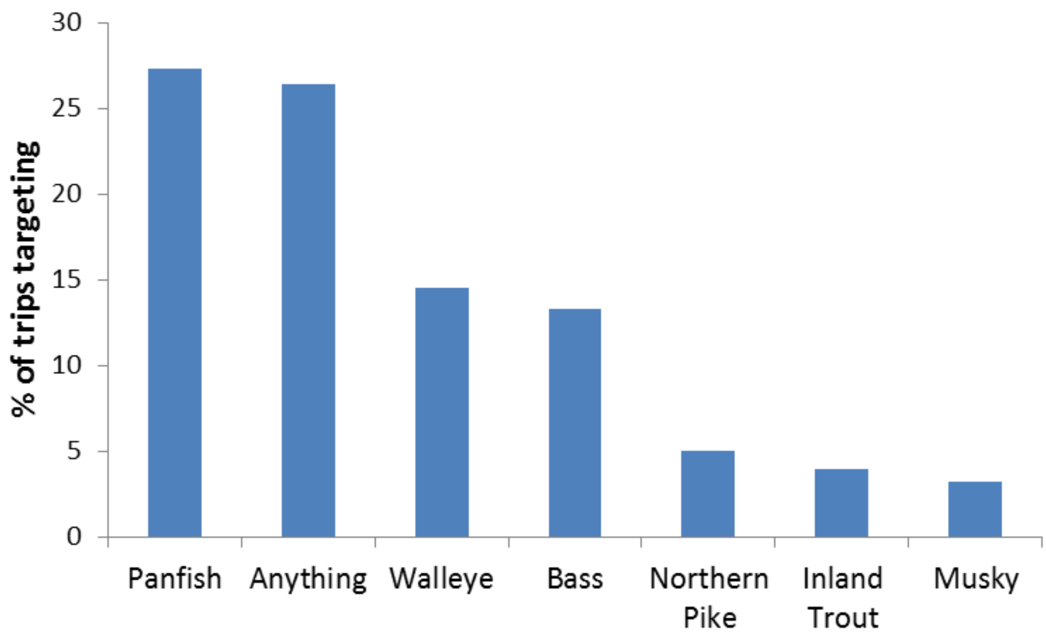

Figure 1. Percent of trips spent targeting most popular fish species or groups in Wisconsin during the 2014-2015 angling season.

Despite their widespread prevalence and popularity, panfish often get less management attention than other "gamefish" species such as walleye (*Sander vitreus)*, muskellunge (*Esox masquinongy*), and trout. For example, no statewide management plan exists for panfish despite ample planning, evaluation, and guidance work being completed. The need for a statewide panfish management plan (Plan) is clear and this document serves to fill that void.

Scope and Purpose

As described below the reader will find relevant management history; current status and trends information; background on development of the Plan; goals, objectives, strategies, and action items; and specific recommendations for plan implementation. The target audience is anyone who is interested. That said, fisheries management has technical concepts and a propensity for jargon. We've tried to make the document approachable by offering additional explanation and definitions where appropriate.

This document is intended to provide a broad strategic statewide perspective and context for managing panfish in *inland* lakes and streams in Wisconsin over the next 10 years (for Great Lakes discussion see their relevant strategic plans). It is not an operational document but provides strategies and recommendations to take steps towards achieving the listed goals and objectives as well as develop specific operational guidance.

Background and history of panfish management

Historically, management focused on addressing populations of bluegill that were considered "stunted". Addressing "stunted" bluegill populations was usually done by encouraging liberal harvest, removing panfish with nets, selective poisoning to reduce large year classes, intensive piscivore (fishes that eat other fishes) stocking, and/or supplemental feeding. No formal guidance existed for panfish management until the 1980s.

In the early 1980s, a Panfish Committee convened to develop population standards and management strategies for centrarchid (i.e. black basses, sunfish, and crappie family of fishes) panfish, which came to be known as the Centrarchid Panfish Management Guidelines (Appendix A) and remains the operational guidance for biologists as a chapter in the Fisheries Management Handbook (Appendix A). Their focus was on improving and protecting habitat, controlling detrimental species, and reducing abundance to avoid stunting. Substantial discussion focused on the role of piscivores in reducing panfish abundance and the complex interactions of various gamefish piscivores, panfish, and anglers. While harvest regulations are one of the core tools in a fisheries manager's toolbox, little attention was paid in using panfish regulations to structure populations until the 1990s.

Recent Use of Regulations

Throughout the 20th century panfish management seemed to oscillate between more liberal and more conservative regulations (Table 1). Starting in the early 1990s, the interest seemed to be in more conservative regulations, with the Natural Resources Board (NRB) directing the fisheries program to evaluate the need for reduced bag limits on certain waters. The Panfish Committee initiated a review and through the analysis of creel and survey data, showed a steady decline in panfish size over time from 1967 – 1991 according to fyke net survey data and creel survey data (Beard and Kampa 1999). They also found that angler's opinions reflected this decline. The majority of anglers (60%) characterized their panfish experience as fair or poor and "catching too many small fish" was the most frequently cited complaint (WDNR 1992).

Due to the declining trends in panfish size and emerging research on the implications of angling removing large individuals from the population, The Panfish Committee suggested an experimental regulation on approximately 30 lakes. They suggested additional protection for large individuals while encouraging the harvest of small individuals. Specifically, the aggregate bag limit would be 50 fish of which no more than 5 bluegill could be greater than 7 inches, and no more than 5 black crappies or yellow perch could be greater than 9 inches (WDNR 1992). An alternative regulation change option offered at the time was a bag limit reduction from 50 to 25 panfish in aggregate. The NRB opted to forward the statewide 25 bag limit reduction over the experimental size limit to the spring hearings in 1993 which was supported, yet the regulation change was rejected by the legislature. Three years later the NRB once again proposed a statewide bag limit reduction to 25 panfish which was again supported at spring hearings and then by the legislature, going into effect in 1998 and remaining in place through present day.

Table 1. Abbreviated history of panfish regulations in Wisconsin.

Year	Open Season	Limits
Pre-1925	All year	None
1925	June 1 - March 1	Varied by waterbody
1943	Southern Zone employed - delayed season	More restrictive bag in S. zone
1950	Zones eliminated, All year statewide	25 bag in aggregate
1960	All year	None
1965	All year	Statewide 50 bag in aggregate
1990s	All year	Restrictive bags and length limits on some lakes
1998	All year	Statewide 25 bag in aggregate

As of 2014, the statewide bag limit remains at 25 panfish in aggregate which covers over 95% of the actively managed lakes in Wisconsin. However, the number of lakes with more restrictive regulations has increased to 143 (Table 2). Most of these lakes use the standard "toolbox" option of an aggregate bag limit of 10 panfish which is generally intended to improve size structure.

Table 2. Number of lakes with special panfish regulations in 2014-2015 fishing year.

Regulation Description	Number of Lakes
Minimum length for crappies is 10" and bag limit for panfish is 10 in total.	2
No minimum length limit and the daily bag limit is 10.	137
No minimum length limit and the daily bag limit is 15.	1
No minimum length limit and the daily bag limit is unlimited.	5
The minimum length limit is 8" and the daily bag limit is 10.	1
The minimum length limit is 8" and the daily bag limit is 15.	2

Beyond the Centrarchid Panfish Management Guidelines developed in the early 1980s, no statewide management plan exists for panfish. In 2005, the Panfish Management Team (PMT; formerly known as the Panfish Committee) was charged with developing a statewide management plan, essentially updating the "Panfish Management Recommendations to the Natural Resources Board" (WDNR 1992).

What do we know about managing Wisconsin panfish?

In 2012, the Panfish Management Team conducted a literature review to compile the information garnered from published studies on reproduction/recruitment, growth, and mortality of black crappie, bluegill, and yellow perch (Fayram et al. 2012, Niebur et al. 2012, and Neuswanger et al. 2016). The following section highlights the most relevant management implications from the literature review. For specific citations see the full literature reviews.

The body of literature used to inform panfish management is highly technical and full of jargon. For readers not familiar with fisheries jargon, here are few helpful definitions the reader can refer to through this document.

Term	Definition
Adaptive Management	Process of applying multiple management actions on a broad scale and in an experimental way to facilitate evaluation and learning
Centrarchid	Family of fish including largemouth bass, smallmouth bass, sunfishes (pumpkinseed, bluegills, and their hybrids), and crappies, among others
Density-Dependent Growth	When growth is reduced because high densities of individuals compete for limited resources
Esocid	Family of fish including northern pike and muskellunge, among others
Fishing Mortality/Exploitation	The proportion of fish removed from a population by angling in a year
Littoral	Shallow water area of a lake
Macrophytes	Aquatic plants
Natural Mortality	The proportion of fish removed from a population from natural causes (e.g. eaten by other fish, die from old age) in a year
Piscivore	Any fish that eats other fish; can be another name for predator
Proportional Size Structure (PSS)	An index to measure size structure. Calculated by dividing the number of fish over a specified size (e.g. "quality" size = 6" for bluegills) by the number of fish over the size vulnerable to capture aka "stock" size (e.g. 3" for bluegill). Specified size denote as superscript in PSS (e.g. PSS^Q = fish over "quality" size, PSS^P = fish over "preferred" size.
Recruitment	A term that can be defined in many ways depending on the context but generally the number of fish surviving to some point early in their life, often to their first fall; can be thought of as a measure of reproduction similar to year class strength
Size Structure	A term describing the size of the individuals in a population, high size structure means lots of large fish, low size structure means lots of small fish
Spawning stock	The amount of spawning fish in a population
Year Class Strength	A term used to describe the number of fish hatched in a year compared to other years, big year class means above average reproduction; can be synonymous with recruitment
Yield	Biomass or weight of fish harvested from a population
Population Dynamics	A general term used to describe the various components associated with understanding how a fish population functions (i.e. growth, mortality, reproduction, recruitment)

Black Crappie

Black crappie often produce varying sized year classes which can be driven by a multitude of factors. In reservoirs, water level fluctuation and discharge rates are often important factors. High and stable water levels can lead to more consistent recruitment but these factors are often out of a manager's control. Some research suggests that maintaining a strong adult spawning stock of crappies can lead to stable recruitment, but environmental drivers are typically more influential. Density-dependent growth can be an issue when large year classes are present or recruitment is consistently high. Moderate to high abundance of piscivores (often walleye) can reduce crappie recruitment which could be detrimental in cases where recruitment is limited, or beneficial where recruitment is excessive and contributing to density dependent slow growth. Understanding variation in year class strength and growth rates in a given lake is key for selecting management actions and monitoring plans. Table 3 offers management actions for several commonly observed types of crappie populations

Table 3. Suggested management action (excluding habitat manipulations) for various black crappie population types based on a literature review.

Recruitment	Growth	Natural Mortality	Fishing Mortality	Action
Variable	Moderate to High	Moderate to low	Moderate to high	Reduce Bag Limit
Low, stable	High	Moderate to low	High	Length Limit
High, stable	Low	Moderate to low	Low	Increase predator abundance
Moderate	Moderate	High	Moderate to low	No further restrictions

Black crappie growth is driven by a number of factors, some density-dependent and others density-independent. While the amount of forage certainly influences growth rates, stocking forage is not cost-effective and offers additional ecosystem hazards. Largemouth bass *(Micropterus salmoides)*, walleye, and to a lesser extent northern pike (*Esox lucius*) in high densities can improve growth rates by reducing density dependent competition. Crappie growth is influenced by habitat in that extreme high or low densities of macrophytes often result in slow growth. Moderate levels of macrophyte and other cover types should be sought after to improve crappie growth. Reducing exploitation on crappies through restrictive regulations can result in increased densities and reduced growth but this will vary based on a lake's productivity and recruitment. Managers should be wary of restrictive regulations where growth rates are already slow.

Natural mortality rates of a crappie population can make or break management actions that restrict harvest. These management actions usually come in the form of angling length or bag limits. If trying to maximize yield in a population with high natural mortality rates, minimum length limits or restrictive bag limits are generally not advisable. However, if growth is fast, minimum length limits can successfully increase yield or improve size structure. Bag limits may be effective in the same situation provided consistent fast growth is shown, but likely need to be reduced to levels below 10 fish per day to be effective. Given the variation in growth rates and angler harvest patterns on crappie populations, additional experimentation with black crappie is needed.

Bluegill

Recruitment and reproduction are usually not limiting factors for bluegill populations and excessive recruitment can be a management challenge by inhibiting growth (aka “stunting”). Manually removing eggs, larvae, or juveniles through mechanical or chemical means should generally not be pursued as these actions are not cost-effective. Predation may be the only practical and affordable way to reduce excessive bluegill recruitment in Wisconsin lakes, and it will not work everywhere. Among the available piscivores, there is no expectation that esocids (northern pike and muskellunge) will consume enough bluegills to affect bluegill population density or size structure. Smallmouth bass (*Micropterus dolomieu)* rarely eat bluegills and are generally found in low densities and thus do not control bluegills.

Largemouth bass populations are well known to control bluegill recruitment, particularly in small lakes (≤250) with simple fish communities. However, their effectiveness seems to wane in larger lakes or in the presence of more-preferred species of prey such as yellow perch and crayfish when abundant. In larger lakes, walleyes may be effective predators on bluegill and other panfish species. The major limitation in broadly utilizing walleye as a bluegill predator is the biological, social, and fiscal challenges in establishing and maintaining sufficient walleye densities, particularly in small lakes with insufficient walleye habitat. Moreover, walleyes have been undergoing broad regional declines. Given these limitations and the fact that the majority of lakes in Wisconsin are small, further research on what lake parameters enable largemouth bass to effectively limit bluegill recruitment in Wisconsin lakes is warranted.

Bluegill growth is largely regulated by density-dependent processes but also unique reproductive life history characteristics. Excessive reproduction in systems with limited resources can lead to “stunted” populations, where growth is slow and individuals rarely achieve preferred size (>6”); this can be exacerbated by dense macrophytes which inhibit effective predation. Supplemental feeding is not cost-effective but some habitat enhancement techniques (e.g. “fish sticks” additions) may increase fish production in a lake – however, research is needed to evaluate this claim. As discussed above, piscivore predators also offer a potential solution to stunting by reducing excessive recruitment.

Sexual stunting is an alternative explanation for slow growth supported in the literature, however the extent of this phenomenon is unclear. Sexual stunting occurs when large males are removed from a population and remaining smaller males mature early in life devote energy to spawning as opposed to growing larger. When large males are present, remaining males tend to devote more energy to growth or adopt alternative strategies such as mimicking or sneaking (see Neuswanger et al. 2016 for more). A growing body of research suggests that sexual stunting has important implications for bluegill size structure and thus retaining as many large parental males in the population is paramount.

Box 1. What's the deal with "Stunting"?
The concept of "stunting" can be confusing and often is used to characterize a population without any large individuals. For example, if anglers fishing a heavily fished lake are unable to catch bluegills larger than 6", they may chalk it up to stunting when in fact all the 6" bluegills have simply been harvested. In reality, "stunting" is overpopulation leading to a reduced growth rate and high natural mortality, resulting in few fish reaching angler-acceptable size. This factor is generally caused by excessive reproduction, insufficient predation, limited resources, or any combination of these factors. Additionally, "sexual stunting" is a phenomena occurring when large males are removed from a population and the remaining males mature at earlier ages, which results in smaller fish because their energy goes to reproduction rather than growth.

Generally, anglers are the largest driver of bluegill mortality and size structure in lakes that are capable of growing quality size fish (i.e. non-stunted lakes). There is little doubt among fishery scientists that size-selective harvest by anglers can cause rapid declines in bluegill population size structure and fishing quality in all but the most lightly exploited or uniquely productive fisheries. Yet, the traditional belief (historically advertised by DNR fisheries managers) that we must "fish 'em hard" in order to "thin 'em out" still exists among many anglers, requiring fishery managers to better inform anglers about the real factors affecting bluegill fishing quality. Studies in Minnesota and Wisconsin show that restrictive harvest regulations can improve bluegill size structure but angler misconceptions about bluegill management presents barriers to anglers accepting restrictive regulations. The balance between an effective regulation (i.e. restrictive enough to alter behavior) and a socially acceptable regulation (i.e. liberal enough to provide a satisfactory amount of harvest) is tenuous. Moreover, the type of regulation (e.g. reduced bag limit, modified length limit, spawning season restriction) that strikes this balance could come in many shapes and forms. An adaptive management approach that applies multiple regulation options on many selected lakes across Wisconsin in a structured large-scale experimental approach is an optimal way to explore the biological and social trade-offs of bluegill regulations (WDNR 2015).

Yellow Perch

Yellow perch are a preferred prey for numerous piscivores, including walleye, largemouth bass, and northern pike. Thus predation plays a large role in yellow perch population dynamics, including recruitment. Large year classes of yellow perch may result in slow growth but this problem can be addressed through increased predation. Alternatively, predation can seriously limit yellow perch recruitment, thus reductions in piscivore predator biomass may be necessary in some cases. Protection and construction of spawning habitat such as littoral wood and/or limited macrophytes may offer the potential to bolster recruitment and/or refuge from predators.

Other small fish species such as gizzard shad (*Dorosoma cepedianum*) or invasive rainbow smelt (*Osmerus mordax*) directly or indirectly interact with yellow perch to influence recruitment. Gizzard shad can serve as a buffer from predation while rainbow smelt are known to outcompete age-0 yellow perch. Understanding the role of other small bodied forage fishes is important, as is preventing the introduction of non-native species.

Population density is a major determinant of yellow perch growth. In instances where yellow perch are overly abundant, growth and size structure tends to be poor. Protecting predatory capacity is the preferred management approach in these cases. However, it is unclear how frequently yellow perch are over-populated and growing slowly in Wisconsin lakes.

Adult yellow perch mortality is largely regulated by predation, including angler harvest. Abundant piscivores can increase mortality which can be beneficial if size structure and growth are poor but could also be detrimental if survival is limiting recruitment. Fishing mortality can be a major factor in structuring yellow perch populations, particularly since anglers are selective in catching and keeping the largest yellow perch, which are often females. Effectiveness of angling regulations is unclear as creel surveys are expensive and exploitation appears to be highly variable. Ultimately, preservation or enhancement of complex shallow water habitat (e.g.woody debris or macrophytes) is important for maximizing survival of yellow perch at various life stages.

Declines in yellow perch abundance across the western Great Lakes region are of concern, evidenced by negative trends in statewide long-term standardized gill net surveys from Minnesota (Bethke and Staples 2014). Anecdotal accounts from Wisconsin suggest similar patterns, although the source of these declines is unclear. Possible causes include variation in spring water temperatures, increases in water temperatures, loss of habitat, increased angling mortality, increased predator abundance, and foodweb changes—these factors are most likely interacting with other unknown factors to decrease many populations. Regardless, additional research is needed to characterize the status and trends of yellow perch in Wisconsin.

Trends and Current Status of Panfish in Wisconsin

WDNR biologists have been collecting panfish data over the last 30 years which provides valuable insights into population trends and current status.

Trends

A re-assessment of Beard and Kampa (1999) shows that the negative trend in panfish size has continued although there is some indication that the decline has leveled off since approximately 2000 (Rypel et al., *In press;* Figure 2). Further analysis is needed to conclude that the negative trends have abated considering historic data appears somewhat cyclic. Regardless, the negative trends in panfish size are a reflection of the average lake – the data should be viewed as a random sample of lakes. Thus, not all lakes have poor size structure, and in fact, many lakes have phenomenal panfishing opportunities.

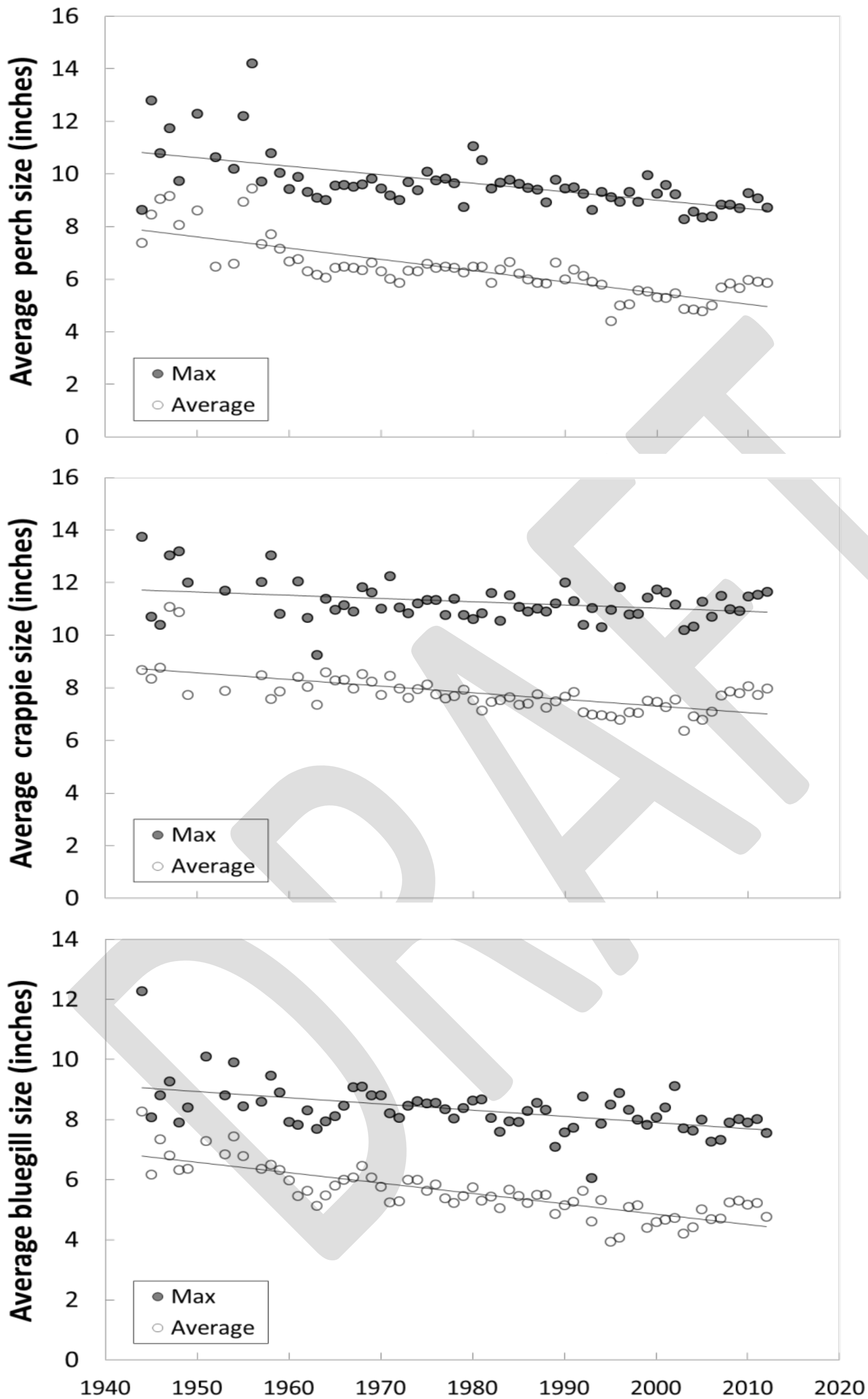

Figure 2. Trends in panfish average and maximum size captured during spring fyke netting. Top panel shows yellow perch, middle panel shows black crappie, and bottom panel shows bluegill.

Status

The 1986 Centrarchid Panfish Management guidelines offer monitoring targets for black crappie and bluegill, specifically metrics that characterize size structure (how large the fish are in a population) and relative abundance (how many fish are in a population) (Table 4). Yellow perch were not addressed in the 1986 guidelines but similar targets should be appropriate to assess status.

Table 4. Population parameter targets offered in 1986 Centrarchid Panfish Guidelines.

	Size Structure		**Relative abundance of quality size**		
Species (Stock, Quality, Preferred length)	**PSS^Q**	**PSS^P**	**Fyke Net Night**	**Electrofishing catch per mile**	**Angler catch per hour**
Black Crappie (5”, 8”, 10”)	40*	5*	20	20	1
Bluegill (3”, 6”, 8”)	40-60	5	20	20	1

*Guideline needs to be reached only once in 3 year period because erratic year classes are considered normal

Relative abundance is calculated as the number of fish captured per unit of sampling effort with the assumption that all fish encountered were counted. The size structure metrics are calculated by dividing the number of individuals over some specified size (varies by species) by the total number of individuals captured (or those captured that are vulnerable to capture). Specifically, Proportional Size Structure of “quality” sized fish (PSS^Q) or “preferred” size fish (PSS^P). Where,

PSS^Q = # fish measured > “quality” size/# fish measured > “stock” size

and

PSS^P = # fish measured > ”preferred” size/ # fish > “stock” size

(for “stock” and “quality” sizes see first column of Table 4).

The two primary panfish survey methods in Wisconsin are spring electrofishing or spring fyke netting. Sampling has been standardized for bluegill both to measure relative abundance and size structure using spring electrofishing. Accordingly, the majority of recent WDNR panfish surveys have focused on sampling bluegill. Black crappie and yellow perch are usually sampled using spring fyke netting but the specific protocols (e.g. when/whether to count fish, when or how many fish to measure, etc) still need to be finalized. Thus, to assess current status of black crappie, yellow perch, and bluegill we used carefully screened data from the Fisheries Management Statewide Database. Specifically, black crappie and yellow perch size structure was assessed using spring fyke net surveys conducted since 2007 where more than 15 fish were measured. Bluegill size structure and relative abundance (CPE>3”; # of bluegill >3 inches captured per mile) was assessed using spring electrofishing. Yellow perch and black crappie relative abundance was not characterized because protocols are not standardized and thus we cannot be sure all fish were counted, which is critical to estimating relative abundance.

Size Structure Status

Since 2007, sufficient numbers of yellow perch were capture during spring fyke netting surveys on 117 lakes. PSS^Q averaged 21 which is below the target of 40. More than 80% of the lakes sampled fell short of the size structure targets of 40. The same surveys showed an average PSS^P of 4 across the 117 lakes, below the target of 5 (Table 5).

Since 2007, 165 lakes were sampled with fyke nets where more than 15 black crappies were measured. In those lakes, PSS^Q averaged 54 which is well above the target of 40. Only 24% of the lakes did not meet the suggested target. Average PSS^P was similarly impressive for most lakes averaging 19, with only 24% of lakes falling below the target of 5.

The bluegill dataset was much richer as more electrofishing surveys are done every year compared to fyke net surveys. Since 2007, a sufficient spring electrofishing sample of bluegill was collected from 648 lakes. PSS^Q averaged 34 with approximately 40% of the lakes meeting the 40 PSD mark (Table 5).

Table 5. Panfish size structure status summary for lakes surveyed since 2007 (spring fyke netting for black crappie and yellow perch; spring electrofishing for bluegills).

Species	Number of lakes	Mean Length (in)	Mean PSS^Q	% of lakes >40 PSS^Q	Mean PSS^P	% of lakes >5 PSS^P
Black Crappie	165	8.4	54	76	19	76
Yellow Perch	117	7.1	21	18	4	23
Bluegill	648	5.4	34	40	3	19

Bluegill Relative Abundance Status

The 1986 guidelines offered a relative abundance target of 20 bluegills per mile. Electrofishing surveys targeting bluegill were conducted on 844 lakes since 2007. The average catch rate across all lakes was 95 bluegills per mile, well above the target. In fact, over 70% of the lakes had bluegill catch rates higher than 20 per mile. Relative abundance of larger size fish show similarly high catch rate (Table 6). For example, the number of bluegill greater than 6" ("quality sized") averaged 30 per mile with 44% of lakes exceeding 20 per mile.

Table 6. Mean, median, and maximum relative abundance (electrofishing catch per mile) of various sizes of bluegills from 844 lakes surveyed since 2007.

Metric	Mean	Median	Max	% lakes > 20 per mile
CPE > 3"	95	65	827	71
CPE > 6"	30	14	317	44
CPE > 8"	2	0	40	2

Summary of Trends and Current Status

While panfish size structure has generally been decreasing over the last 50 years, there are signs the declines have lessened. A current status assessment of panfish size structure and relative abundance shows some successes and provides some areas that need improvement. The status of yellow perch size structure is concerning and while we were unable to reliably assess relative abundance, anecdotal accounts and neighboring declines in Minnesota (Bethke and Staples 2014) are additionally concerning. Bluegill size structure on a broad scale is slightly below target yet many lakes have phenomenal size structure. There are plenty of bluegills out there for anglers as relative abundance appears to be exceeding goals, including relative abundance of large fish. Black crappie size structure appears very to be very high on most lakes with more than 3 out of 4 four lakes meeting goals. The current status assessment paints a broad picture by averaging data across many lakes; there will always be a notable number of lakes that do not follow this general assessment.

Lakes Classification

Understanding how panfish populations vary with different kinds of lakes can be very useful for clarifying expectations, making sense of survey data, and guiding management decisions. This concept is generally referred to as lakes classification and work is currently underway to develop a classification system for all major sport fish in Wisconsin. Early work has explored how bluegill relative abundance and size structure is related to different types of lakes and some interesting patterns have emerged, specifically based on lake size. Small lakes tend to have lots of bluegills but often poor size structure. Large lakes tend to have less bluegills but better size structure (Figure 3). Additional classification work is warranted to further explore these relationships and incorporate black crappie and yellow perch data.

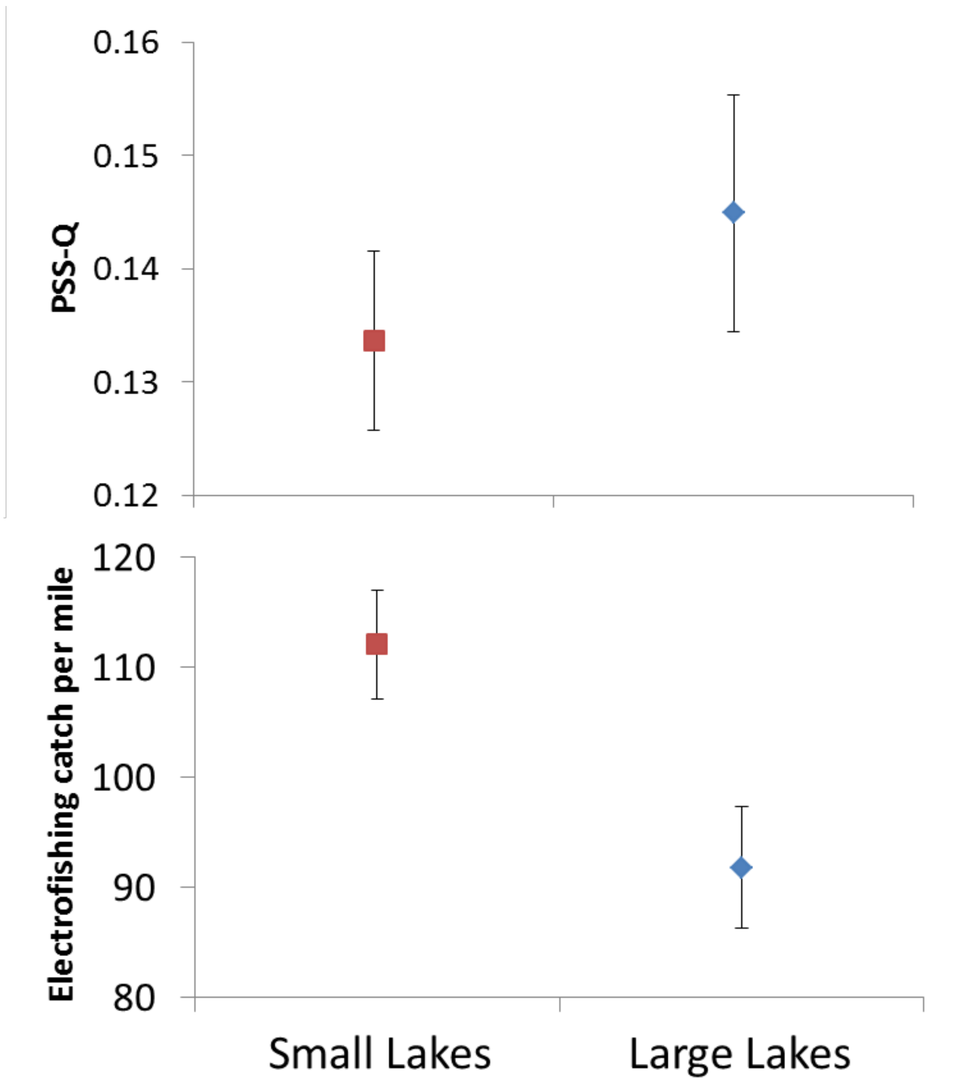

Figure 3. Differences in size structure (PSS-Q) and relative abundance (Electrofishing catch per mile >3”) of bluegills between small lakes and large lakes. Points show averages and bars show standard error, a measure of variance.

Everyone loves Panfish… but are they safe to eat?
Generally speaking, yes! Panfish tend to have lower mercury concentrations than larger gamefish, and the statewide consumption advice is that younger women and kids should limit themsleves to 1 meal per week; for men and older women there is no restriction. Some specific waters do have panfish with higher levels of mercury or PCBs, see the most recent WDNR fish consumption advisory guide or find advice online.

Management Plan Development Process and Public Input

Active development of the Plan has been underway for well over three years. In 2011-2012, the PMT began compiling survey information and related historical documents to set the stage for discussing panfish management with the public. Throughout 2013, panfish stakeholders were engaged in various ways to solicit their opinions on panfish management. A short voluntary survey was developed and offered at approximately 30 public meetings, various sports shows, and online. Multiple press releases alerted people to the development of the Plan and directed them to complete the survey, attend public meetings, and/or offer comments.

The survey asked 10 questions intended to gauge anglers' satisfaction, opinions and interest in management changes. Nearly 3,500 surveys were completed, the majority of which were done online. According to the survey, the public has split views on panfish management needs, including their satisfaction of the current panfish size and the need to change statewide regulations (Table 8). Respondents did indicate a preference for catching larger panfish even if it meant keeping fewer.

Table 8. Summary of responses to 2013 panfish survey (self-selected survey offered online and in person at public meetings) to various questions related to panfish management.

→ *How satisfied are you with the size of your favorite panfish?*

Response	Percent Response
Dissatisfied	31%
Neither dissatisfied nor satisfied	33%
Satisfied	36%

→ *Would you like to see the daily bag limit of 25 panfish increased, decreased or kept at 25?*

Response	Percent Response
Increased	6%
Kept at 25	47%
Decreased	47%

→ *Would you prefer to catch and keep fewer panfish but larger in size or more panfish of average or smaller size?*

Response	Percent Response
Catch fewer but larger panfish	61%
No change in number or size of panfish	33%
Catch more but panfish size is average or smaller	6%

Following the 2013 survey, a set of panfish-related questions were presented during the 2014 Conservation Congress spring hearings. There was overwhelming support for separating regulations by the various species, using piscivore predators to control panfish abundance and improving or protecting habitat to bolster panfish populations (Table 9). The results suggested that there is no clear mandate or need to change statewide regulations but there was interest in experimenting with regulations on selected underperforming lakes

Based on these results the PMT developed and initiated an Adaptive Management Project for Panfish (AMPP) which uses three different experimental regulations on a set of lakes identified by anglers and managers as failing to meet their potential for panfish size. The regulations cover approximately 100 lakes and are effective April 1, 2016. Performance will be evaluated between 2019 and 2021 and necessary adjustments made prior to a regulation sunset in 2026. For more information on the AMPP see WDNR 2015.

Table 9. Summary of responses to panfish related questions found on 2013 spring hearings.

Question	Votes Yes	Votes No	Majority	Counties Approving	Counties Rejecting
General statewide need to increase average size of panfish	2792	2837	No	31	39
General statewide need to spread out panfish harvest	2237	3216	No	11	57
Keeping general panfish combined daily bag limit of 25 fish	3680	1945	Yes	68	2
Separate angling bag limits for bluegill, crappie, and perch	3484	2162	Yes	60	12
High minimum length limits on panfish in specific waters	2639	2893	No	24	47
Reduce bag limits for panfish to determine effects on populations	3169	2396	Yes	54	18
Restrict harvest of gamefish to control panfish abundance through predation	3430	2085	Yes	66	6
Habitat improvements or protection to determine effects on panfish	4937	631	Yes	72	0

STATEWIDE 10 YEAR PANFISH MANAGEMENT GOALS

The public input combined with historical perspectives and background data analysis led to the development of four management goals. These goals also align with some of the goals found in *In the Year 2025: A Ten Year Strategic Plan for Fisheries Management in Wisconsin.*

1. **Use an integrated ecosystem approach to protect, restore, and sustainably enhance panfish populations and habitat**
2. **Provide a variety of panfishing opportunities for diverse sustenance and recreational fisheries-based activities**
3. **Engage new and existing panfish anglers and partners**
4. **Base panfish management decisions on best available data and science, while incorporating social and economic perspectives**

PANFISH MANAGEMENT OBJECTIVES, STRATEGIES, AND ACTION ITEMS

The above management goals are necessarily broad to encompass the varied nature of panfish management. Panfish management comes in various shapes and forms but can be organized by the following topics: habitat, angling regulations, assessment, population manipulation, stocking, outreach, and research. Each topic has an objective which will lead the program to achieving the various goals (applicable goals are listed in the superscript). The objectives were derived based on input from the public, expertise from fisheries staff, information from the literature, and patterns from monitoring data. The strategies should be viewed as the path forward for panfish management to achieve those objectives over the next 10 years. Specific actions are offered to implement the various strategies. Prioritized recommendations, both short-term and long-term, along with benchmarks, follow this section.

Protecting and improving panfish habitat

The most integrated, sustainable, and responsible long-term approach to ensure strong panfish fisheries is to provide sufficient habitat through protection and enhancement. Panfish habitat spans multiple scales and thus protection should encompass considerations from the watershed scale to specific sensitive shoreline. Generally, sustainable panfish fisheries need best management practices to promote healthy and resilient lakes.. Therefore, in-lake panfish habitat work should focus on the preservation of existing nearshore large woody debris and littoral aquatic macrophytes. Further research is needed to understand the fish community implications of nearshore habitat enhancement projects such as “fish sticks”, which are ecologically appealing and have encouraging preliminary results. In addition, removal of rough fish species may reduce re-suspension of suspended solids, reducing turbidity, thus allowing increased light penetration in order to promote submersed aquatic vegetation. From a broad perspective, the public resoundingly supports management approaches focusing on protecting and improving habitat -- this support should be embraced and utilized.

Objective[1]: *Protect and enhance panfish <u>habitats</u> across multiple spatial and temporal scales including in-lake, shorelines, and watershed level habitat*

Strategy 1: Increase outreach that demonstrates the utility and need for riparian and littoral zone panfish habitat

Action A: WDNR staff encourage riparian owners to take advantage of funding opportunities and information from the Healthy Lakes program (which advocates the planting of native vegetation, diversion of runoff, and placement of infiltration structures among other activities)

Strategy 2: Increase panfish production potential and resilience to angler harvest by promoting habitat conservation and enhancement within individual lakes

Action A: Initiate and explore more partnerships to promote “fish sticks” projects as a habitat enhancement and outreach tool to encourage riparian owners to leave wood in the lake. Where “fish sticks” projects are infeasible and other nearshore habitat is lacking (e.g. native macrophytes), large scale fish crib projects should be employed and evaluated.

Fish sticks, fish cribs, and production vs. attraction

The increased public support for and implementation of “fish sticks” projects is encouraging yet long-term responses in the fish community are still unknown, in particular whether they actually increase fish production and favor certain fish species. Moreover, while fish cribs have been widely used in the past, some criticize them for simply attracting fish so anglers have an easier time catching them. That said, there are circumstances where cribs are the only option and, if done on an appropriately large–scale, can be effective. Further research is needed to evaluate projects and develop habitat enhancement guidelines that may vary depending on management goals.

Action B: Encourage stakeholders to engage in natural, ecosystem function focused habitat work and away from projects like small-scale fish cribs (if other options exist) that may be less productive.

Strategy 3: Protect critical shoreline habitat

Action A: Identify and protect shoreline habitat crucial to successful yellow perch spawning

Action B: Identify and protect, through regulation and outreach, sources of undeveloped shorelines as recruitment sources for large woody habitat and preservation of macrophyte beds

Strategy 4: Support activities to prevent the introduction and spread of aquatic invasive species and collaborate in the management of their associated effects on panfish populations

Action A: Encourage lake associations and interested stakeholders to work with Aquatic Invasive Species staff and volunteers to employ prevention and control Best Management Practices (BMPs)

Strategy 5: Collaborate with Aquatic Plant Management (APM) staff to develop guidelines for aquatic plant management that optimizes panfish recruitment and growth

Action A: Consult with Aquatic Plant Management (APM) program staff to develop BMPs for ensuring whole-lake aquatic plant treatments are conducted such that panfish recruitment is not significantly affected

Action B: Identify monitoring strategies to elucidate relationships between the various panfish species and macrophyte coverage

Action C: Evaluate potential panfish issues associated with local authorities conducting mechanical plant harvesting and herbicide treatments

Strategy 6: Effectively managing winterkill in lakes where it is common

Action A: Provide expert consultation to and collaborate with lake associations to manage winterkill issues with aeration when cost-effective

Action B: Encourage yellow perch, a species tolerant of low oxygen levels, as the primary panfish in lakes prone to winterkills

Strategy 7: Reclaim shallow turbid lakes plagued with limited recruitment and macrophytes

Action A: Induce alternative stable state and "flip lake" by attempting to extirpate carp via integrated pest management targeting all life stages

Action B: Encourage rooted macrophytes over algae using drawdowns, boating restrictions, nutrient reductions and/or other proven techniques to promote healthy aquatic plant communities.

Regulating fishing mortality with angling regulations

Managing panfish with angling regulations is controversial and on a broad scale has mixed public support. Although regulations can be biologically effective, a mixture of misinformation, non-compliance, and perceived loss of opportunity bring their social effectiveness into question. Moreover, while most panfish anglers are interested in fishing to take home a meal, they are still heterogeneous in their preferred experience and behavioral patterns. Previous research also showed that restrictive regulations placed on inappropriate waters can backfire and result in angler misconceptions and lack of confidence in agency biologists. Much uncertainty surrounds the use of angling regulations yet they can be very effective, can directly alter size structure in a relatively short time period, and if successful can be very popular locally.

Objective[1,2]**:** *Develop system to diagnose and improve lakes with underachieving panfish populations*

Strategy 1: Identify biologically and socially optimal panfish regulation capable of improving average size on underachieving lakes

Action A: Implement Adaptive Management Plan for Panfish

Strategy 2: Develop framework for classifying panfish populations as overfished

Action A: Use available survey and creel data to identify variables useful in assessing harvest, begin with bluegill expand to other species

Strategy 3: Explore feasibility and experiment with reduced cost creel surveys

Action A: Evaluate methodologies to passively measure angler effort

Action B: Develop angler diary program on subset of lakes as part of evaluation for regulation changes

Population manipulation through predation

In lieu of restrictive fishing regulations, using other piscivores predator fish to reduce juvenile panfish density is an enticing strategy, particularly for bluegill in cases where growth is density-dependent. Piscivore effectiveness is largely dictated by lake characteristics yet uncertainties in these relationships are numerous. In Wisconsin, walleye and largemouth bass are the most effective piscivorous gamefish on small bluegill and yellow perch. Largemouth bass effectiveness appears limited to small lakes with simple food webs where preferred prey such as yellow perch and crayfish are limited. Where present in sufficient numbers walleye may be the most effective piscivore, yet the ability to establish and maintain walleye populations is limited and costly. Alternatively, yellow perch and black crappie recruitment can be limited by excessive predation. More research is necessary to elucidate these complex relationships. Thus, lakes should be selected with care and tradeoffs among all components of the food web must be considered when manipulating predation potential.

Objective[1,2]: *Manage for effective predation of panfish to alleviate density-dependent growth where appropriate while limiting predation bottlenecks on recruitment.*

Strategy 1: Reduce implications of density-dependent growth of panfish by protecting and enhancing effective piscivores

Action A: In small lakes with simple food webs where quality bluegill size structure is desired utilize restrictive regulations on largemouth bass that protect sufficient piscivorous biomass

Action B: In large lakes or small lakes with complex food webs where quality bluegill size structure is desired, utilize regulations and stocking of walleye (where appropriate) to increase piscivorous biomass

Strategy 2: Evaluate effectiveness of management tools to increase piscivore densities and the subsequent effect on panfish size structure

Action A: Evaluate response of panfish size structure to the ongoing Wisconsin Walleye Initiative stocking and how this response varies by lake type

Action B: Evaluate response of bluegill size structure and yellow perch recruitment to increases in largemouth bass and how this response varies by lake type

Assessing panfish populations

Accurately and effectively assessing panfish populations is critical for tracking trends, characterizing patterns, diagnosing problems, and providing information to anglers. Assessment protocols should be standardized to the extent possible as should the criteria used to characterize status and performance. The Department currently has established and widely accepted sampling protocols for bluegill but not black crappie or yellow perch. Moreover, there are indications of regional yellow perch declines yet the lack of standardized long-term data prevent Wisconsin from thoroughly evaluating this claim. Finally, a comprehensive lakes classification system remains an important goal to better manage panfish and understand our survey data.

Objective[1,2,4]: *Accurately assess status and trends of bluegill, black crappie, and yellow perch across Wisconsin in a standardized manner*

Strategy 1: Establish standard sampling protocols for black crappie and yellow perch

Action A: PMT and Monitoring Coordinator finalize protocols and update Fish Management Handbook

Strategy 2: Characterize status and sampling effectiveness of yellow perch populations across Wisconsin using various gears

Action A: Initiate research project to conduct in depth evaluation of available yellow perch trend data to assess claim of declines

Action B: Initiate research project to conduct empirical assessment of gear comparison, specifically various sized gill nets versus fyke nets

Strategy 3: Establish age and growth protocols for all panfish species

Action A: PMT works with Fish Age Task Group to develop specific protocols

Strategy 4: Develop assessment criteria for performance, including diagnostics for stunted populations, low recruitment, and overfished populations

Action A: Define growth criteria for stunted populations and estimate the number of stunted lakes in Wisconsin

Action B: Use available survey and creel data to identify variables useful in assessing harvest, begin with bluegill expand to other species

Strategy 5: Develop lakes classification system for panfish and create relative abundance, size structure, and growth standards for each class

Action A: Complete current lakes classification effort underway by research staff

Managing panfish populations through propagation

Stocking panfish in Wisconsin waters is a minor aspect of the overall management program and generally limited to re-establishing fisheries following chemical reclamation or winterkills. Very few panfish are produced in WDNR hatcheries and generally bluegills or yellow perch are acquired through federal hatcheries. Historically field transfers have been used to re-establish panfish populations. Although demand exists, current fish health policies restrict the practice to downstream waters. Regardless of the procedure considering genetics is critical.

Objective[1,2]: *Propagate or transfer panfish and stock to re-establish fisheries following reclamations or infrequent winterkills*

Strategy 1: Propagate or purchase sufficient numbers of panfish to re-establish a fishable population where appropriate

Action A: PMT develop bluegill and yellow perch stocking guidance for winterkill or reclamation situations that follow genetic and fish health BMPs

Strategy 2: Efficiently utilize wild source panfish to enhance or re-establish fisheries where appropriate while following stringent fish health and genetic conservation BMPs

Action A: Evaluate cost-effectiveness of capturing stranded panfish and transferring to temporary holding locations (e.g. drawdown situations) to be grown out and re-stocked at a later date

Action B: Explore tradeoffs and develop guidance for conducting field transfers of panfish with specific focus on quantifying the cost-benefit

Action C: Explore utility of transferring wild panfish to urban ponds in lieu of trout stocking

Action D: Work with Fish Health staff to develop guidance for field transfers that prescribes BMPs for minimizing the potential for spreading fish disease

Engaging and informing anglers

Anglers are undeniably central to successful panfish management. Engaging current and potential anglers increases buy-in and support and fosters a relationship of trust and understanding. Additionally, common misconceptions are plentiful with panfish management and providing clear, digestible information throughout the engagement process is critical. In particular, the perception that bluegills should be fished as hard as possible to prevent or address stunting is prevalent and needs to be changed. The challenge is effectively communicating a complex and nuanced message that will certainly change as fish managers learn more.

Objective[3]: *Increase public understanding of panfish management including the complexities of their life history; acknowledge necessary changes in historic messaging*

Strategy 1: Inform anglers of the complexities of bluegill life history with particular emphasis on the misconceptions surrounding stunting

Action A: Write Natural Resource Magazine article, develop fact sheet, update online FAQ documents explaining what we know about bluegill management and how anglers fit in the picture

Action B: Ensure department staff (e.g. Fisheries Management, Law Enforcement, etc…) are familiar with and consistent with messaging

Action C: Post literature reviews completed by the PMT on DNR website and direct interested anglers and sportsman's groups to these documents

Strategy 2: Identify opportunities to message the importance of healthy habitats and a diversified management approach to ensure a strong panfish fishery in the future, particularly in the face of a changing climate

Action A: WDNR staff encourage riparian owners to take advantage of funding opportunities and information from the Healthy Lakes program

Objective[3]: *Increase the frequency with which we characterize angling preferences for all panfish species*

Strategy 1: Periodically conduct social surveys (e.g. statewide angler mail diary) to measure angling preferences including tradeoffs between size and number of panfish

Action A: Collaborate with and fund projects with WDNR social scientists and UW social scientists interested in measuring angler behavior, motivations, and preferences

Strategy 2: Utilize novel creel techniques to measure panfish angler behavior

Action A: Fund and advocate for projects intended to remotely measure angler effort and harvest (e.g. car counters, voluntary diaries, bus route creels combined with cameras or drones to quantify effort, etc…)

Action B: Encourage research to model angler effort based on readily available data

Managing panfish based on sound science

Responsibly managing panfish in a sustainable manner that provides a quality fishing experience relies heavily on science. Without a strong applied research program, managers are forced to make decisions based on substandard and outdated information. The capacity for panfish managers to learn relies on an effective research program. The need to conduct applied but forward thinking research is more important now than ever as Wisconsin lakes undergo unprecedented and unpredictable change. Specifically, understanding how climate change will alter the complex foodwebs where panfish are a key player is paramount. Moreover, identifying and evaluating strategies to foster resilience (e.g. habitat enhancement through woody habitat additions) will become increasingly important.

Objective[4]: *Increase support and capacity for researchers to conduct panfish related research*

Strategy 1: Allocate sufficient resources to research

Strategy 2: Integrate with research staff to identify key information needs

Action A: On a biannual basis, identify and prioritize list of panfish related research needs (FY 2015-2017 list included as Appendix B)

Action B: Develop recurrent opportunities for management and research staff to interaction and collaborate (e.g. seminar series, invitations to fish team meetings

Strategy 1: Collaborate with research staff to inform and design modeling and field experiments to answer panfish management questions

Action A: Maintain research presence on PMT

Prioritized recommendations and plan implementation

The following offer short-term and long-term prioritized recommendations as a means to implement the plan.

A. Short-term (significant work done over next 3 years)
    - Implement and follow through with the AMPP
    - Develop specific criteria for characterizing "stunted" populations
    - Active outreach to dispel stunting and "need to harvest" myths
    - Develop outreach tools to advocate for effective habitat enhancement and protection
    - Establish standard sampling protocols for black crappie and yellow perch and age and growth protocols for all panfish
    - Further asses yellow perch status and trends

B. Long-term (shift direction over next 10 years)
    - Continue research aimed at understanding how panfish populations can be effectively managed
    - Focus on habitat (protection and enhancement) and land-use as remediation for climate change and accompanying uncertainty
        - Diversify management actions across the landscape and evaluate their effectiveness
    - Increase angler engagement to improve our ability to gauge preferences and transfer technical knowledge

Citations

Beard, T. D. and J. M. Kampa. 1999. Changes in Bluegill, Black Crappie, and Yellow Perch Populations in Wisconsin during 1967-1991. North American Journal of Fisheries Management, 19:4, 1037-1043.

Becker, G. C. 1983. Fishes of Wisconsin. University of Wisconsin Press, Madison.

Bethke, B. and D. F. Staples. 2014. Changes in the Relative Abundance of Several Minnesota Fishes from 1970 to 2013. Transactions of the American Fisheries Society, 144:1, 68-80

Fayram, A., M. Wolter, M. Sorge, and J. Griffin. 2012. A literature review of management approaches based on rate functions associated with black and white crappie populations. Wisconsin Department of Natural Resources, Bureau of Fisheries Management, Madison, WI.

Neuswanger, D. J. *In review.* A Synoptic Review of the Ecology and Management of Bluegill Sunfish (*Lepomis macrochirus*) with Implications for Fishery Management in Wisconsin. Wisconsin Department of Natural Resources, Bureau of Fisheries Management, Madison, WI.

Niebur, A., P. Short, and J. Griffin. 2012. A literature review of management approaches based on rate functions associated with yellow perch populations. Wisconsin Department of Natural Resources, Bureau of Fisheries Management, Madison, WI.

Rypel, A. L., J. L. Lyons, and J. D. Griffin. *In press.* Seventy-year retrospective on size structure changes in the recreational fisheries of Wisconsin. Fisheries.

Wisconsin Department of Natural Resources. 1992. Managing Panfish in Wisconsin: A recommendation to the Natural Resources Board. Bureau of Fisheries Management, Madison, WI.

Wisconsin Department of Natural Resources. 2015. An Adaptive Management Project for Panfish: Identifying regulations to increase bluegill and black crappie average size in Wisconsin. Bureau of Fisheries Management, Madison, WI.

Appendices

A. Centrarchid Panfish Management FM Handbook Chapter
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B. Panfish related research needs identified for 2015-2017 biennium through research prioritization process.

Project title	Priority
Lakes Classification	High
Management actions for addressing slow growth (stunted) panfish populations	High
Aquatic plant management and panfish	High
Implications of bed fishing for bluegills	High
Panfish assocations or responses to coarse woody habitat enhancement projects	High
Yellow Perch and black crappie sampling protocols for inland lakes	High
Walleye stocking impacts on bluegills/panfish (growth and R)	High
Stocking guidance for winterkill (or "clean slate") lakes	Other
Characterizing exploitation of panfsih	Other
Understanding trends and patterns in recruitment	Other
Overwintering and fish congregations, particularly in Mississippi River	Other
Bluegill as biological control for carp	Other