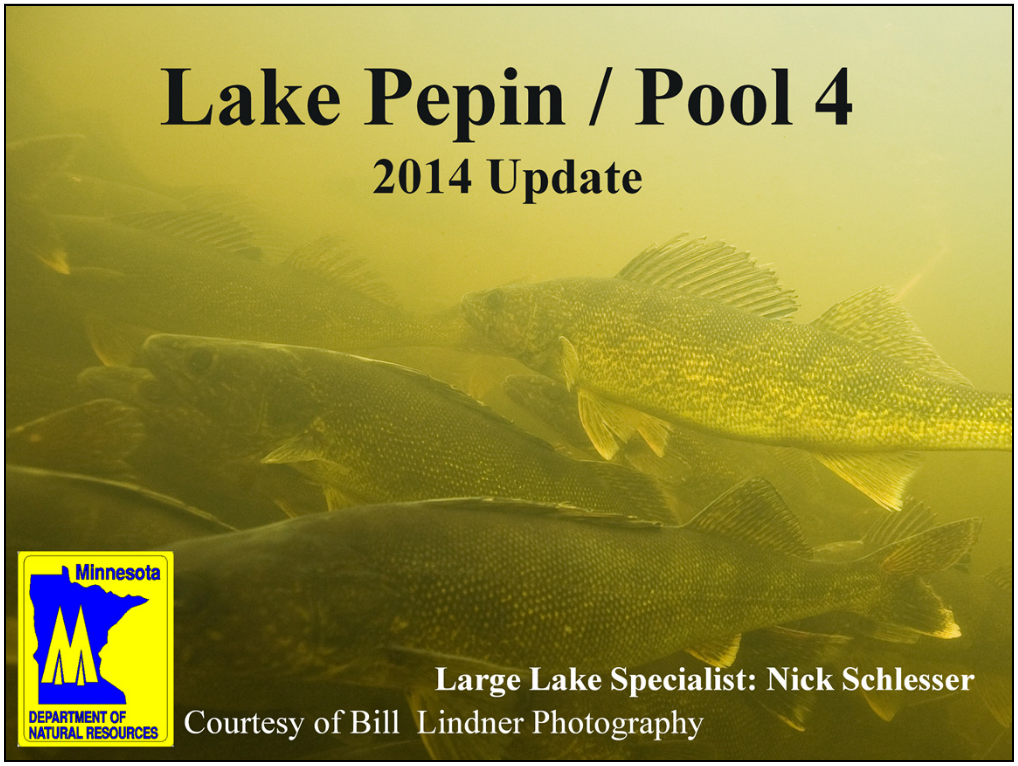
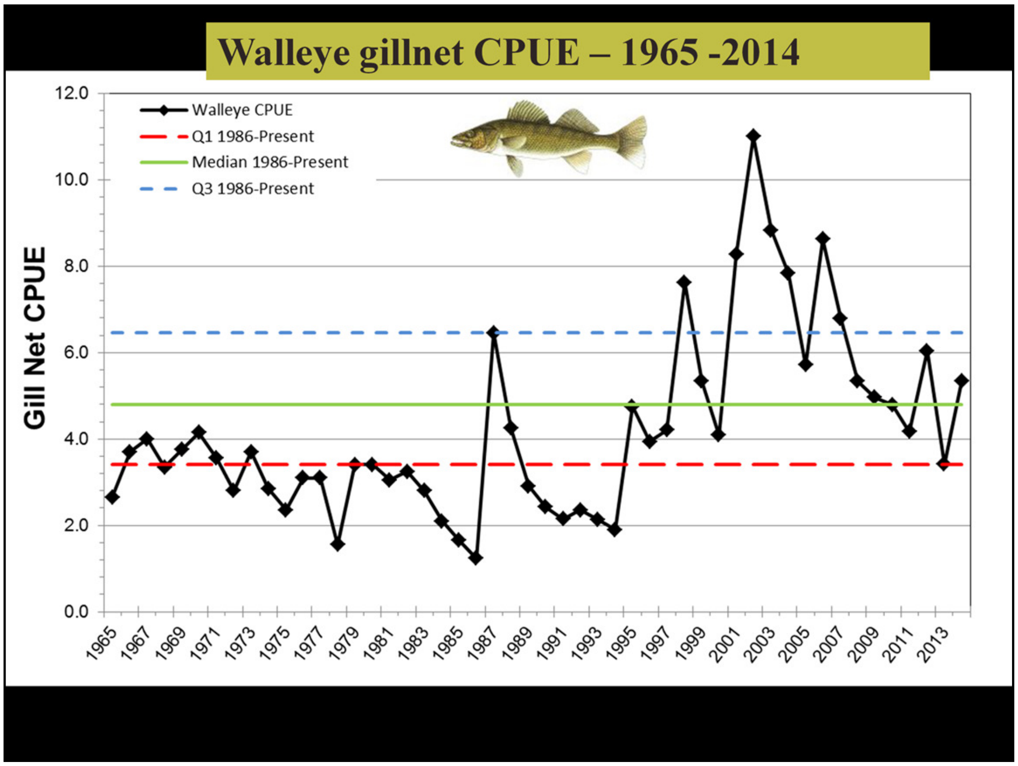

Lake Pepin / Pool 4
2014 Update
Minnesota
DEPARTMENT OF NATURAL RESOURCES
Large Lake Specialist: Nick Schlesser
Courtesy of Bill Lindner Photography

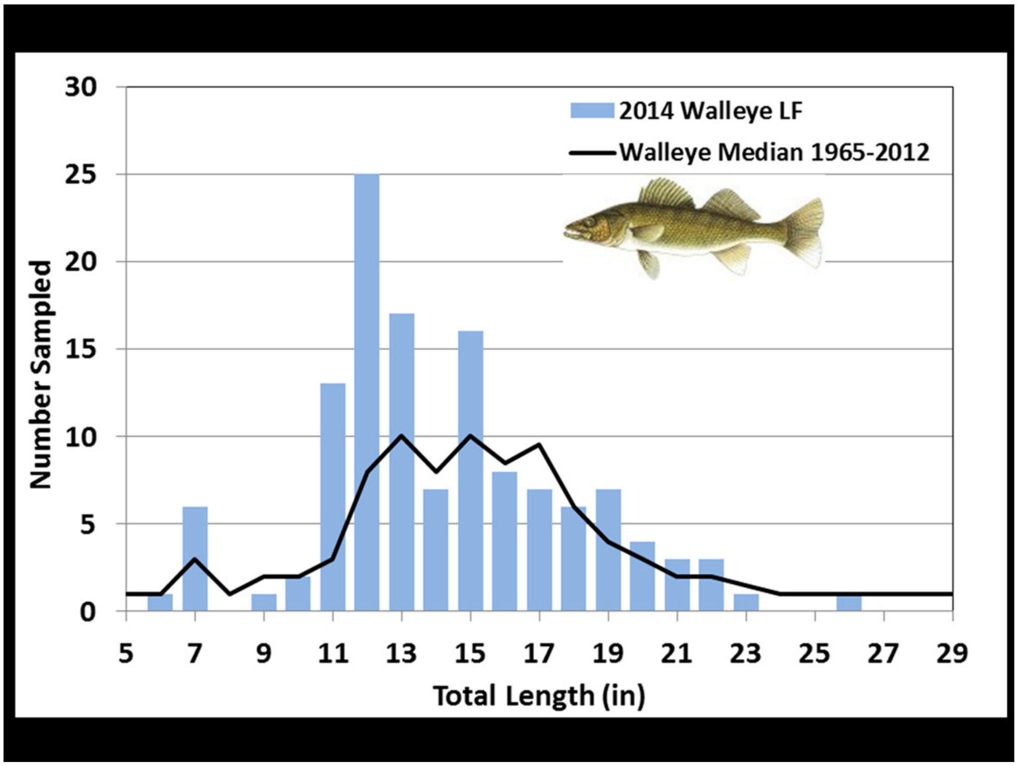


Catch per Unit Effort (CPUE) represents the average number of fish captured per net. Annually as part of the large lake survey 24 gill nets are set for ~24 hour periods in the first week of October. These gillnets provide a cross section look at the adult populations of some of the most popular gamefish in our lakes (Walleye, Sauger, Yellow Perch, etc). It should be noted that some gamefish like Largemouth and Smallmouth Bass are poorly sampled using this type of gear.

This figure shows that while Lake Pepin's walleye population is down from historic highs driven by the incredibly strong 2001 year class it is still above the long term (1986-Present) median.

Year class strength Index (YCSI) is a normalized way of representing how important the contributions of a particular years hatch of a species is to the population in a body of water by looking at the contribution of the year class at ages 1 and 2 to the gill net catch. Note 2011 is a borderline strong year class and 2013 is looking like a strong year-class, but only has one year of sampling so far and may be adjusted up or down depending on the catch of 2013 walleyes at age 2 in the fall of 2014.

In this case the incredibly strong 2001 Walleye year class that I noted on Slide 2 is very obvious. Typically we consider a year class to be “strong” if it is above the green line and “weak” if it falls below the red line. As you can see the strong year class from 2009 is contributing to good numbers to the current fishery. See slides 4 and 5 for more information on the 2009 year class.



This slide represents the number of Walleyes from each 1 inch size group that was captured in the 2012 gillnets (blue bars) and the long term median for the same information from 1965-2012 represented by the black line.

As you can see the 2013 year class is represented here primarily by the 11-13 inch range and seems to be over performing the long term median as indicated in the YCSI slide. Also the 19-22" fish are present in higher than average numbers due primarily to the 2009 year class.

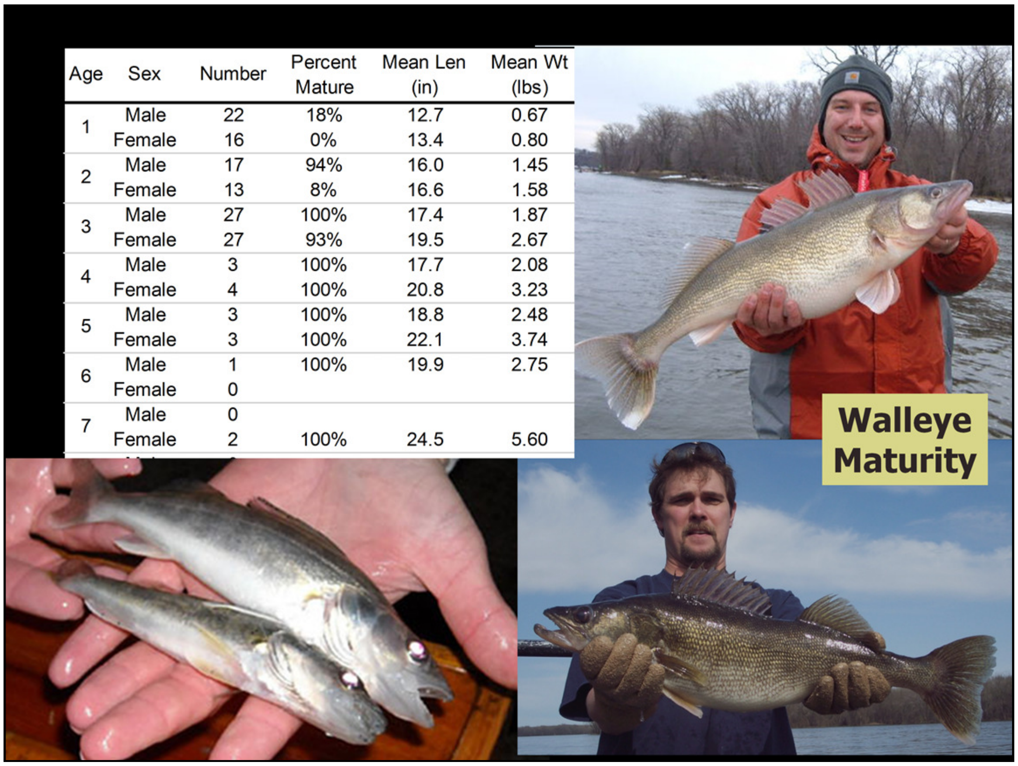
Length Group	Sample size	Subsample size	Age 0	1	2	3	4	5	6	7	8	9	10
5.0 - 5.9	0	0											
6.0 - 6.9	1	1	1										
7.0 - 7.9	6	6	6										
8.0 - 8.9	0	0											
9.0 - 9.9	1	1	1										
10.0 - 10.9	2	2		2									
11.0 - 11.9	13	13		12	1								
12.0 - 12.9	25	24		25									
13.0 - 13.9	17	16		15	2								
14.0 - 14.9	7	7			7								
15.0 - 15.9	16	16			10	5	1						
16.0 - 16.9	8	8			4	4							
17.0 - 17.9	7	7			1	5	1						
18.0 - 18.9	6	6				5		1					
19.0 - 19.9	7	7				2	1	3		1			
20.0 - 20.9	4	4				1	1	1		1			
21.0 - 21.9	3	3				1	1	1					
22.0 - 22.9	3	3					1	2					
23.0 - 23.9	1	1						1					
24.0 - 24.9	0	0											
25.0 - 25.9	0	0											
26.0 - 26.9	1	1								1			
Totals	128	126	8	54	25	23	6	9	0	3	0	0	0
Percent			6.3	42.1	19.6	18.0	4.7	7.0	0.0	2.3	0.0	0.0	0.0
		Mean Length (in)	7.6	12.4	15.2	17.6	19.4	20.9		22.2			
		Standard Deviation	0.66	0.72	1.16	1.65	2.39	1.90		3.93			
		Minimum Length (in)	6.7	10.6	11.9	15.5	15.9	18.4		19.3			
		Maximum Length (in)	9.1	13.7	17.6	21.5	22.1	23.9		26.7			

* Unable to age fish in this group.

This is an Age-Length Frequency table that shows how many Walleye of each age group were captured in the gillnets in 2014 by one inch increments. For example there were 54 Age-1 Walleye (hatched in 2013) that were between 10.6 and 13.7 inches in length. There were also 3 Age-2 Walleye (hatched in 2012) that fell into that length category. The sample size column represents the total number of Walleye sampled from that length group in the gill nets in 2014. The subsample size column represents the number of fish for each size group that I aged by removing a bone called an otolith (ear stone) from inside the fish's head. This bone can then be cracked in half, toasted over a candle flame, and looked at under a microscope where the heat from the candle causes distinct light and dark annual rings to emerge much like those found on a cross section of a tree. When all of the fish in a size group are not aged the unaged fish are proportionally distributed across the represented ages indicated by those fish that were aged.

One important thing to note when looking at Age-Length Frequencies, particularly for Lake Pepin, is the speed at which the fish, Walleyes in this case, are growing. This growth is much faster than most other bodies of water in Minnesota when combined with what is also a relatively short lifespan (typically <10 years in Lake Pepin and potentially >20 in the northern lakes in MN) and represents some interesting management and regulation challenges.

Also important to note on Walleye in particular the 2008 year class (Age-6) appeared weak (but present) in the YCSI figure, but no individuals were captured in the 2014 gill nets. This may be due to the potential for Walleye to outgrow our nets (get too big to be sampled effectively by our gear), it may be due to the fact that they have been in the harvestable size for four years and have likely experienced considerable angling pressure, or it may be due to natural mortality from old age or in the case of a year like 2012 an extended period of time with water temperatures near or above 90 °F.



Age	Sex	Number	Percent Mature	Mean Len (in)	Mean Wt (lbs)
1	Male	22	18%	12.7	0.67
	Female	16	0%	13.4	0.80
2	Male	17	94%	16.0	1.45
	Female	13	8%	16.6	1.58
3	Male	27	100%	17.4	1.87
	Female	27	93%	19.5	2.67
4	Male	3	100%	17.7	2.08
	Female	4	100%	20.8	3.23
5	Male	3	100%	18.8	2.48
	Female	3	100%	22.1	3.74
6	Male	1	100%	19.9	2.75
	Female	0			
7	Male	0			
	Female	2	100%	24.5	5.60

If you were at the Walleye Searchers meeting you may notice this slide was not in my presentation. There were however several questions about when Walleyes mature and begin spawning. This data is from several years ago so the numbers will not match the rest of the presentation, but the ages and percent maturity are fairly consistent between years and show that almost all males are mature by the time they are Age-2 and almost all the Females are mature by the time they are Age-3.

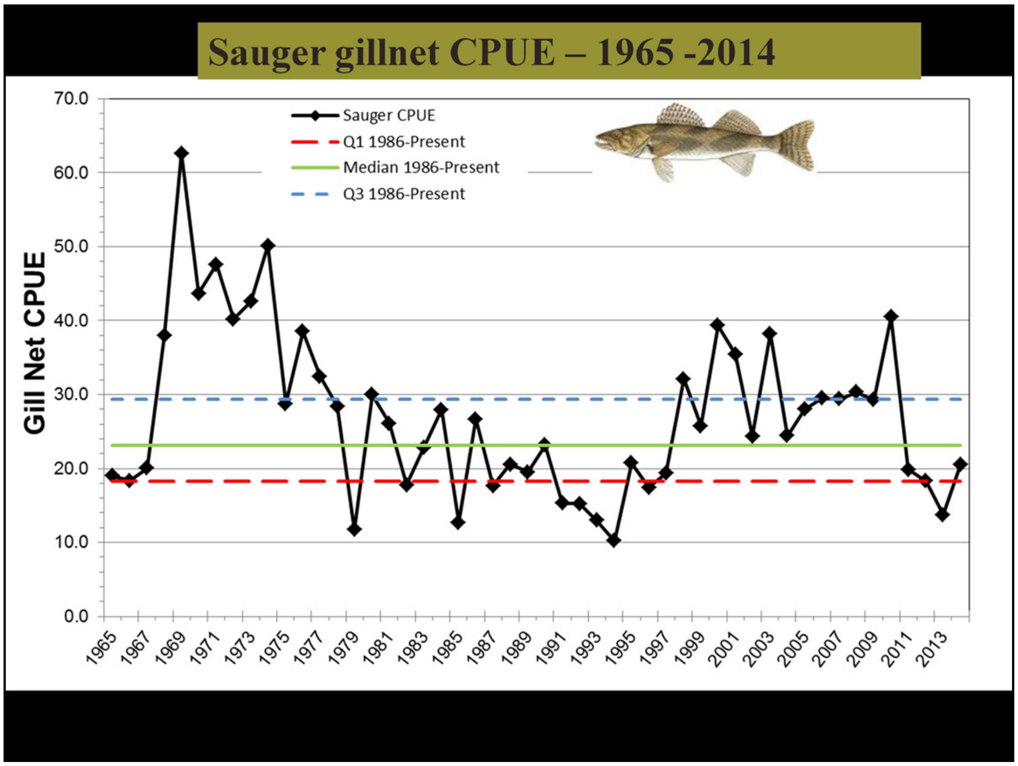
I know there has been a bit of confusion in the past about how we refer to fish ages so I will provide a quick review here. By convention all fish are considered to have a birthday on January 1st and all of our gillnet sampling occurs in October so I have laid our a lifecycle for a hypothetical Walleye from an ageing perspective below.

1. Walleye hatches in April 2000 (for simplicity sake) and grows until October. (Lives through first summer)
    - If we catch it in the gill nets here it would be considered a YOY (young of year) or an Age-0 because it has not had a birthday yet.
2. Walleye lives through the winter and in the spring of 2001 is an Age-1. (Lives through second summer)
    - By October if we caught it in the gill net it would be an Age-1 and have ~18% chance to be mature (meaning it will spawn in the coming spring as an Age-2) if it is a male.

3. Walleye lives through the winter and in the spring of 2002 is an Age-2. (Lives through third summer)
    - By October if we catch it in the gillnet it would be an Age-2 and if a male would most likely (94%) be mature and possibly be mature (8%) if a female. If mature they will spawn in the spring as an Age-3
4. Walleye lives through the winter and in the spring of 2003 is an Age-3. (Lives through fourth summer)
    - By October if we catch it in the gillnet it would be an Age-3 and if a male would (100%) be mature and most likely be mature (93%) if a female. If mature they will spawn in the spring as an Age-4 at the beginning of their 5th summer.
5. Walleye lives through the winter and in the spring of 2004 is an Age-4. (Lives through fifth summer)
    - Almost all fish are mature at this point. All males and 97% of females will spawn at this age.

Gear	Time of Year	Catch	Status
Trawl	August	4.8/hr	Slightly above average
GN	October	0.33/net	--
Fall YOY EF	November	--	Lake Froze No Sample

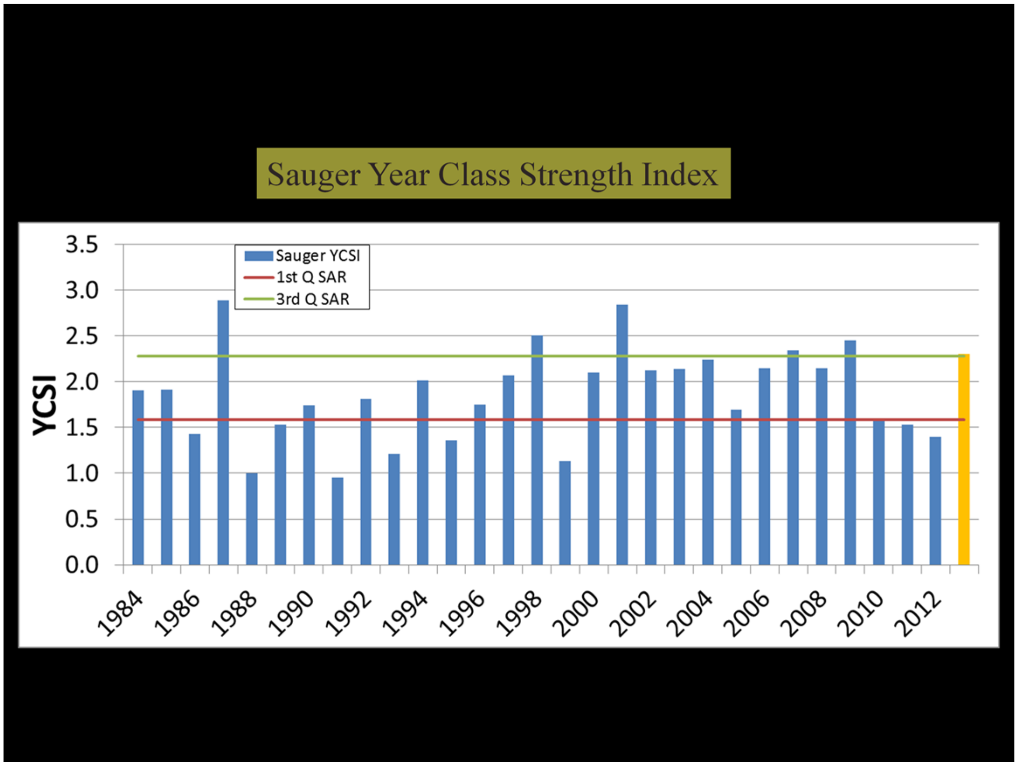
Our efforts to identify strong year classes of Walleye and Sauger in particular start in their first year of life when we monitor their numbers and growth from July (seining), through August (trawling) and October (gill netting), and into November (nighttime electrofishing). Our most accurate estimates of the years reproduction come during November when many hours of electrofishing are done on cold nights to capture and count young of year (YOY) Walleye and Sauger. The early freeze up of Lake Pepin in November of 2014 prevented us from getting a complete sample of young of the year Walleye or Sauger in 2014 so estimates of the 2014 year class strength will have to wait until 2015.



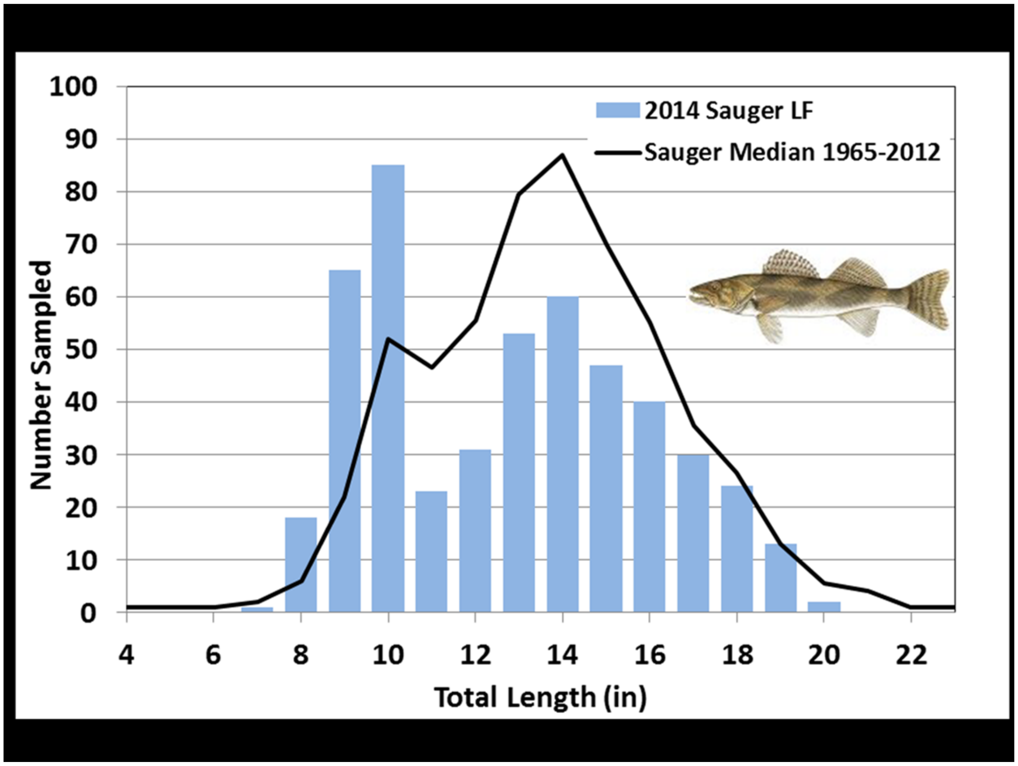
See Slide 2 for more complete description of this type of figure.

This figure shows that Lake Pepin's Sauger population is down from recent high levels driven by the incredibly strong 2001 year class and a series of strong year classes in the late 2000s.

While the catch number has fallen to below the median for the 1986-Present dataset it remains high compared to most other lakes in MN. The dramatic drop between 2010 and 2011 remains a bit of a mystery, but may be partially due to high water and open dams allowing fish populations to freely move around the river system (This assertion was supported by Xcel Energy sampling which showed dramatic increases in catch rate for Sauger and Walleye in lower Pool 3 in 2011 indicating likely upstream migration). Regardless, the relatively low YCSI for Sauger in 2010, 2011, and 2012 have not produced an abundance of surplus fish to rapidly increase net catch, but the apparently strong year-class of Sauger in 2013 bumped the 2014 net catches up by more than 25% from 2013..



Lake Pepin Sauger have been incredibly consistent in their reproduction during the early 2000s, with no year class until potentially the 2011 year class being considered weak. While it is important to get another good year class before too long in a system where sauger rarely live longer than 10 years one important thing to consider is the effect of long term high production on expectations and metrics. Continued strong production shifts both angler expectations and averages (net catch, YCSI, etc) higher such that what was once considered good might now be considered average. That being said, early indications are that 2013 produced a borderline strong year-class, though it will likely fluctuate up or down a bit over the next two years as it recruits to the fishery.



See Slide 4 for a more complete description of this figure.

The Sauger catch in 2014 clearly shows the good production of Sauger in 2013 (8"-10") as well as the general underrepresentation of the previous three years of production. Unlike the past year or two however the larger size classes of Sauger (18"+) though not abundant, are once again available to anglers.

Because Sauger often don't fully recruit to our gillnets until Age 2 we will likely see the peaks in the 9 and 10 inch columns go up next year during the 2015 netting as they recruit more fully to the gear as Age-2 fish.

Length Group	Sample size	Subsample size	Age 0	1	2	3	4	5	6	7	8	9	10	11	12
5.0 - 5.9	0	0													
6.0 - 6.9	0	0													
7.0 - 7.9	1	1		1											
8.0 - 8.9	18	17		18											
9.0 - 9.9	65	32		65											
10.0 - 10.9	85	35		85											
11.0 - 11.9	23	23		15	7	1									
12.0 - 12.9	31	26		1	29	1									
13.0 - 13.9	53	27			35	16		2							
14.0 - 14.9	60	26			23	23	7	7							
15.0 - 15.9	47	26			7	24	7	7		2					
16.0 - 16.9	40	23				19	7	14							
17.0 - 17.9	30	27				1	6	19	1	1	1				1
18.0 - 18.9	24	24				1	7	11	2	3					
19.0 - 19.9	13	13					1	8	2		1		1		
20.0 - 20.9	2	2							1		1				
21.0 - 21.9	0	0													
Totals	492	302	0	185	101	86	35	68	6	6		0	1	0	1
Percent			0.0	37.6	20.6	17.4	7.0	13.8	1.2	1.2	0.6	0.0	0.2	0.0	0.2
Mean Length (in)				9.9	13.3	15.1	17.0	17.5	19.1	17.4	18.9		19.2		17.8
Standard Deviation				0.94	0.99	1.40	1.48	1.43	1.18	1.35	1.56				
Minimum Length (in)				7.9	11.5	11.7	14.1	13.8	17.4	15.2	17.3		19.2		17.8
Maximum Length (in)				12.1	15.5	18.9	19.5	19.9	20.7	18.6	20.4		19.2		17.8

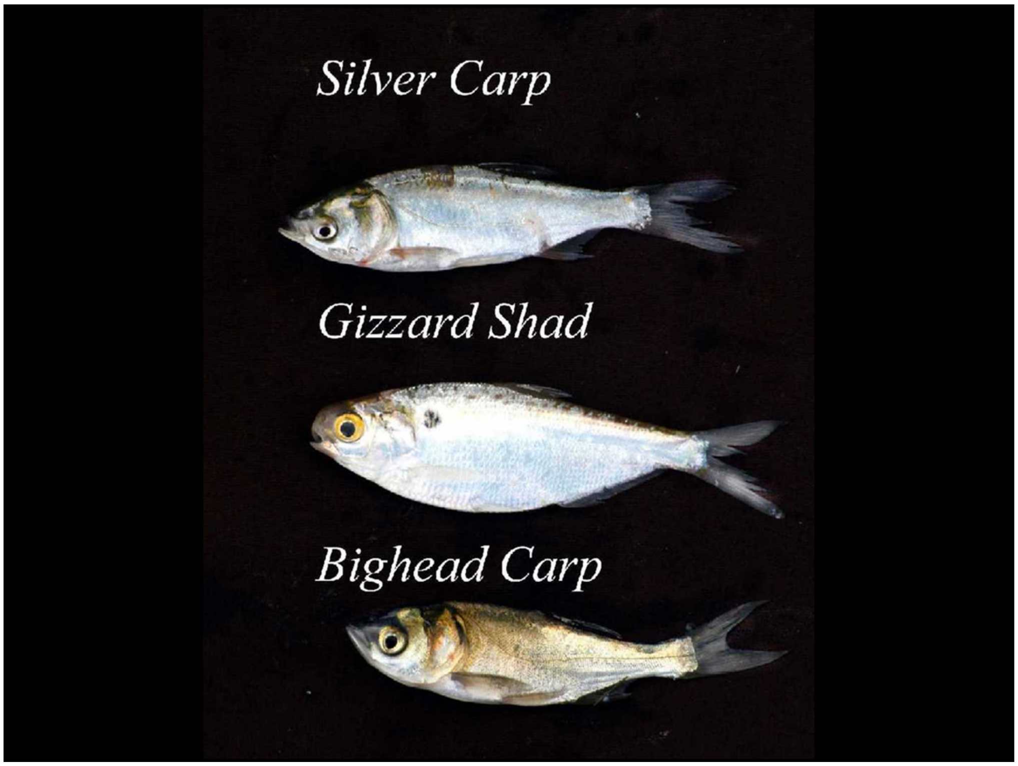
* Unable to age fish in this group.

See Slide 5 for a more complete explanation of this figure.

I have often told groups that Lake Pepin Sauger rarely live longer than 10 years (particularly females) and this year we sampled 2 individuals (both male) that beat that mark, however, of the 9 Sauger that were over age-6 all but one were male.

Gear	Time of Year	Catch	Status
Trawl	August	2.8/hr	Below long term mean
GN	October	0.0/net	--
Fall YOY EF	November	--	Lake Froze No Sample

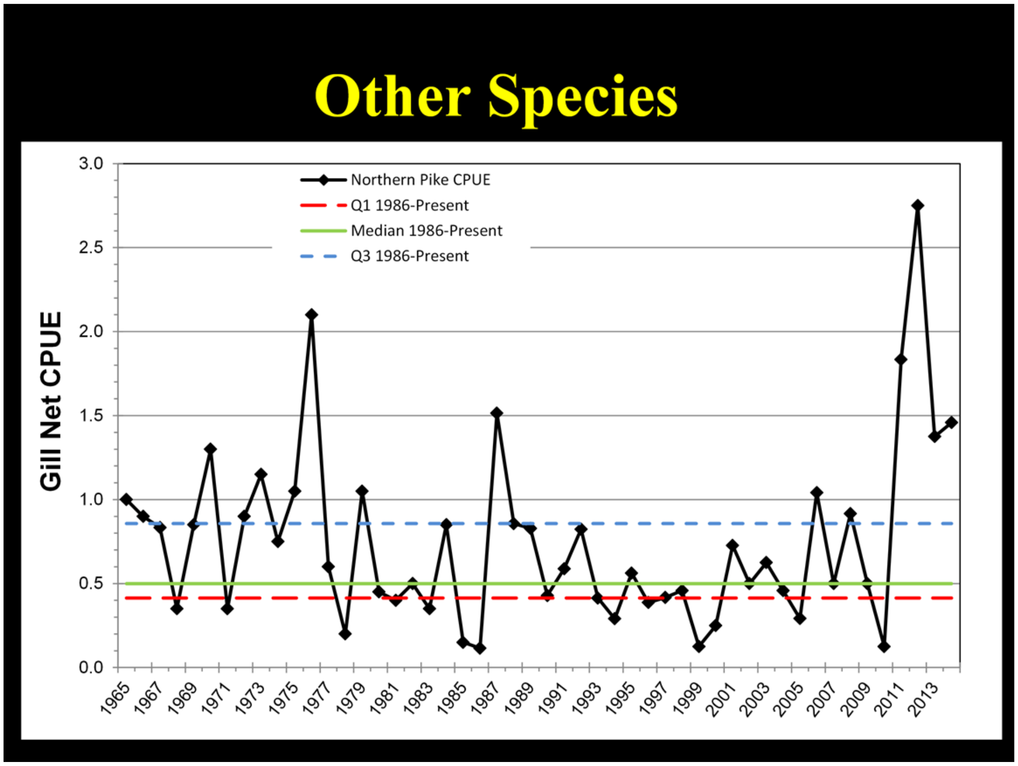
Our efforts to identify strong year classes of Walleye and Sauger in particular start in their first year of life when we monitor their numbers and growth from July (seining), through August (trawling) and October (gill netting), and into November (nighttime electrofishing). Our most accurate estimates of the years reproduction come during November when many hours of electrofishing are done on cold nights to capture and count young of year (YOY) Walleye and Sauger. High water in 2014 would tend to indicate a “good” year for spawning, but the early freeze up of Lake Pepin in November 2014 prevented us from conducting our fall electrofishing survey that provides our best estimate of year class strength in a fish’s first year of life.



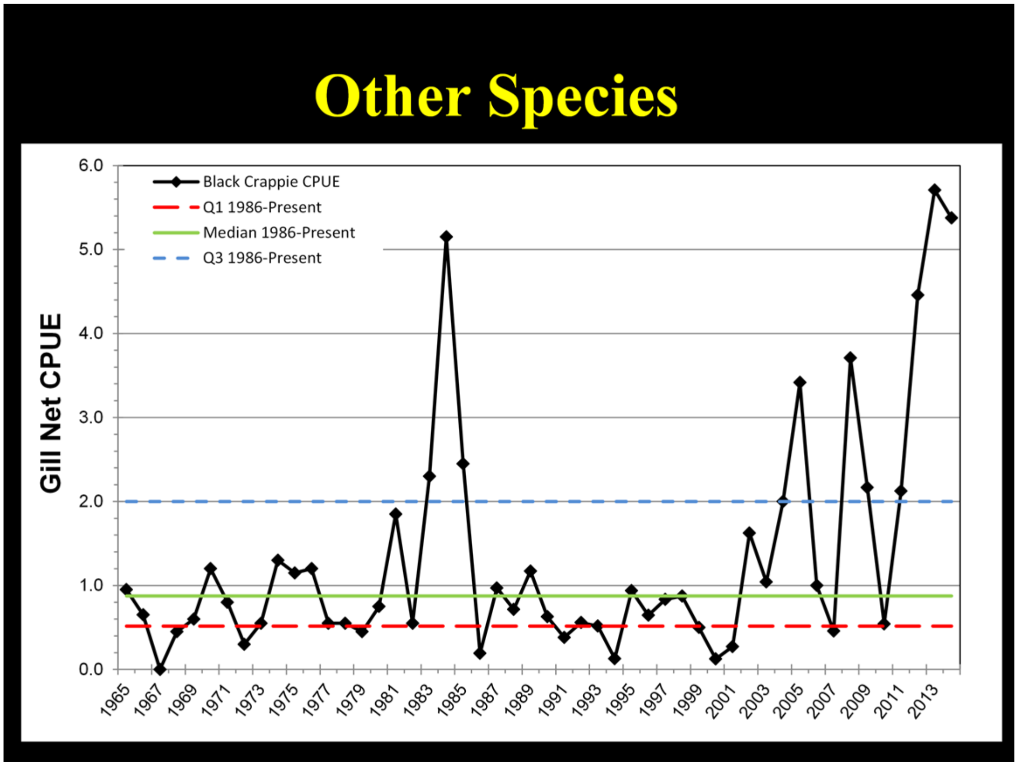
The similarities of YOY Asian Carp and Gizzard Shad means extra diligence is necessary when doing our young of the year monitoring on Pepin to watch for these invaders. As of the end of 2014 we have not identified any reproduction of the invasive carp species in Minnesota waters of the Mississippi River.


Juvenile Lake Sturgeon
caught in Trawl
TURTLE RIVER, MN

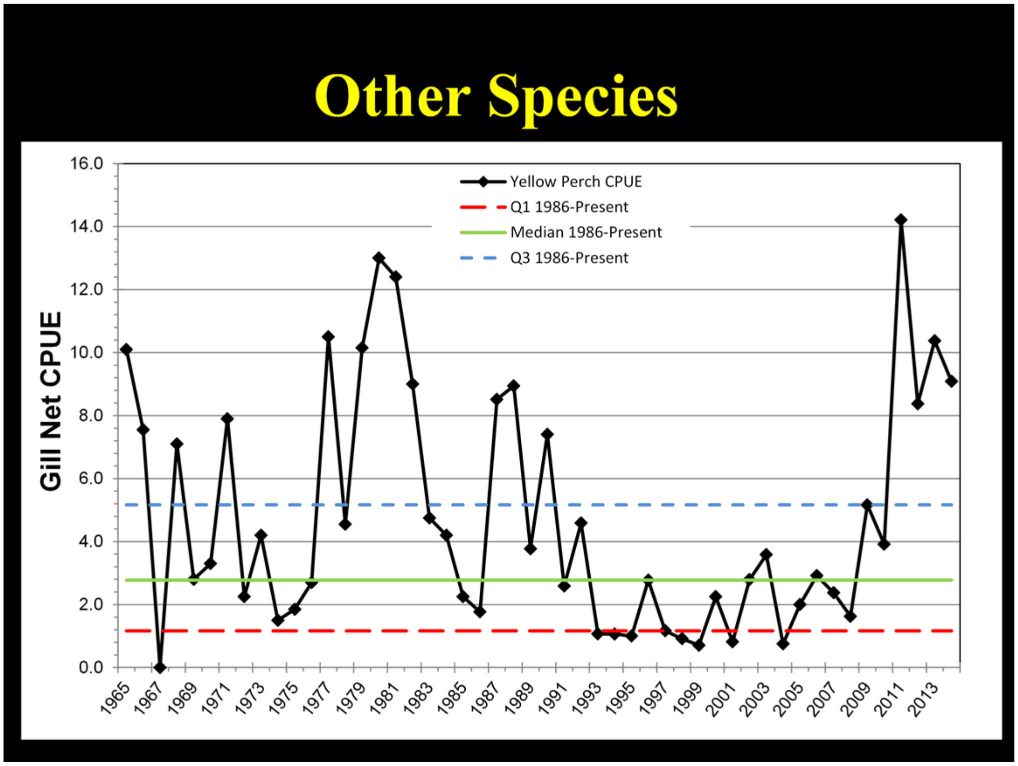
What might be a YOY or at the oldest an Age-1 Paddlefish caught in a trawl haul off Long Point in Lake Pepin in August of 2012.



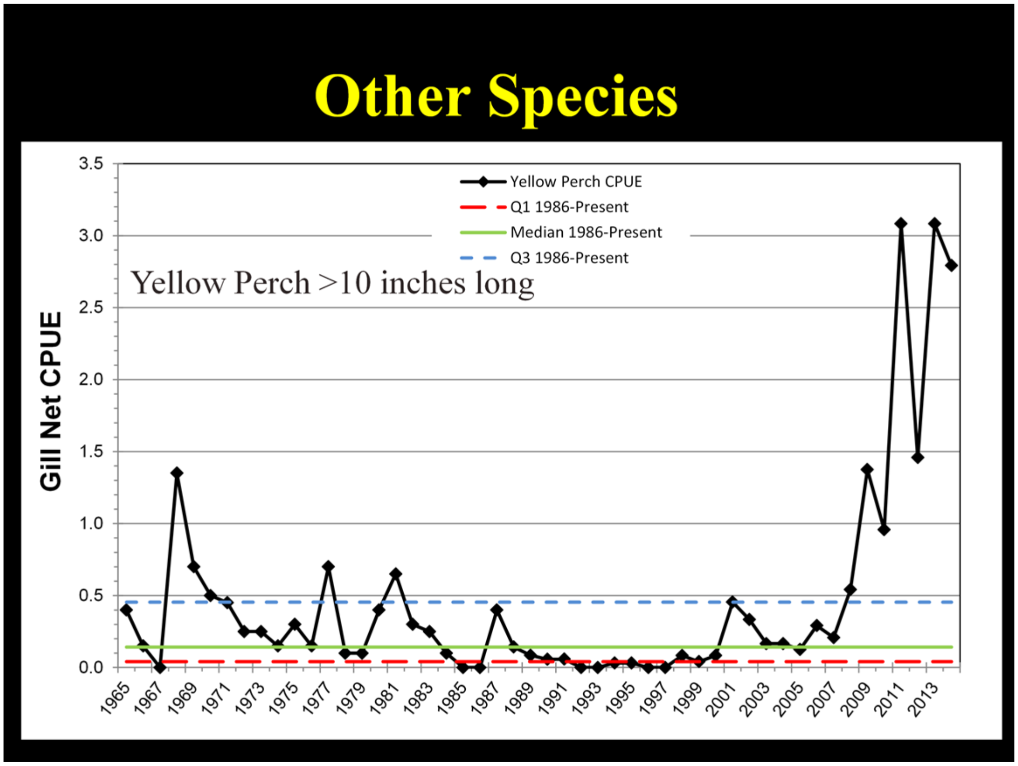
Northern Pike gill net catch history showing the recent increase in Northern Pike population likely as a result of increased water clarity and submerged aquatic vegetation.



Black Crappie gill net catch history showing the recent increase in Black Crappie population likely as a result of increased water clarity and submerged aquatic vegetation combined with the last three years of record breaking or near record breaking Black Crappie year-classes in Lake Pepin.



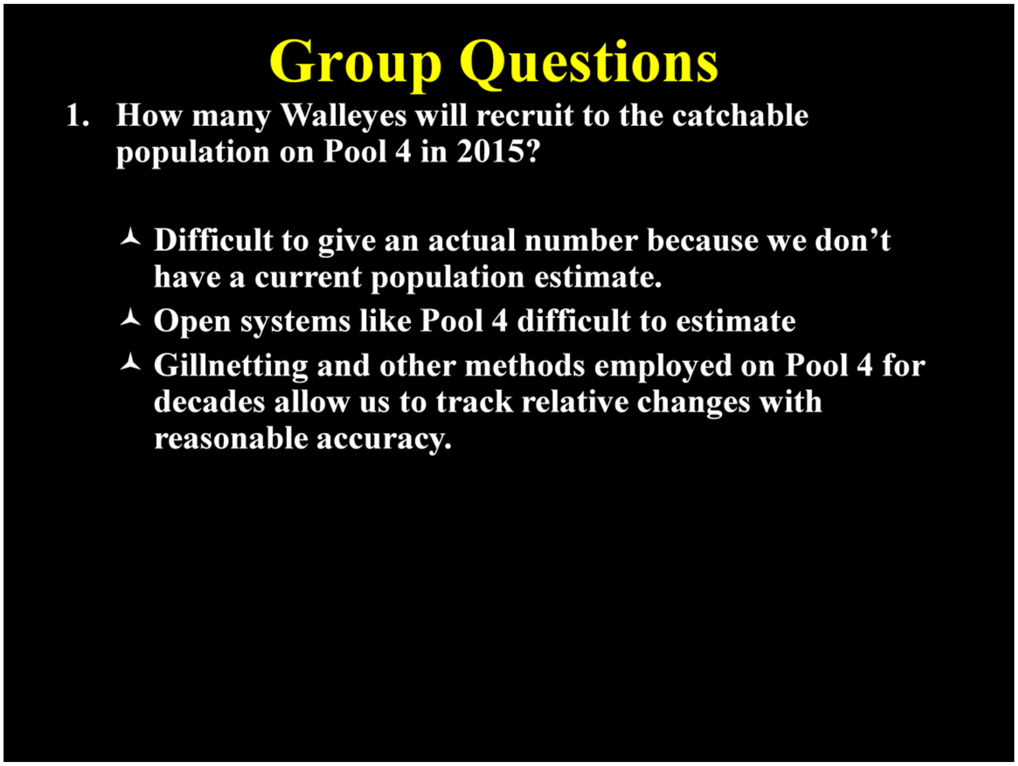
Yellow Perch gill net catch history showing the recent increase in Yellow Perch population likely as a result of increased water clarity and submerged aquatic vegetation needed for perch reproduction.



Gill net catch of Yellow Perch >10” showing the recent and unprecedented increase in the population of large Yellow Perch.

Group Questions

1. How many Walleyes will recruit to the catchable population on Pool 4 in 2015?
2. What is the purpose of stocking lakes that don't have the characteristics necessary for natural reproduction?
   a) Any purpose beyond sportfishing?
3. What ratio of Walleyes on pool 4 are:
   - resident river fish – river spawning
   - resident lake fish – lake spawning
   - resident lake fish – river spawning
4. What is the maximum temperature change Walleyes can tolerate?
5. In your research have tournaments affected the larger Walleye population on Pool 4?
6. What are the ideal spawning conditions for Sauger and Walleye?
   a) How do they differ?



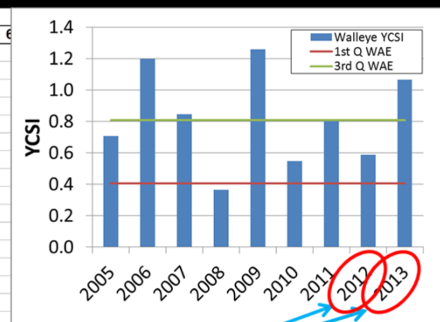
As I mention in the slide giving an actual number of individuals that will recruit to the anglers is difficult. We don't have an actual population estimate (a number of individuals) for Walleye in Pool 4, and are unlikely to get one because generating population estimates require expensive tagging projects (with many thousands of fish tagged) and because as an open system (system where fish can swim in or out for either end through the dams) breaks the rules used to calculate the estimate which makes calculating the estimate even if you had the tagging study is extremely complicated if not impossible.

That being said our long term data sets from various sampling methods and in the case of Walleye and Sauger particularly our gillnetting data which is annual since 1965 allow us to be reasonably confident in relative changes in the population. For example I can say the population is up slightly or maybe even that the population is up by approximately 50%, but I could NOT say that the population went from 50,000 Walleye to 80,000 Walleye because we don't have that population number.

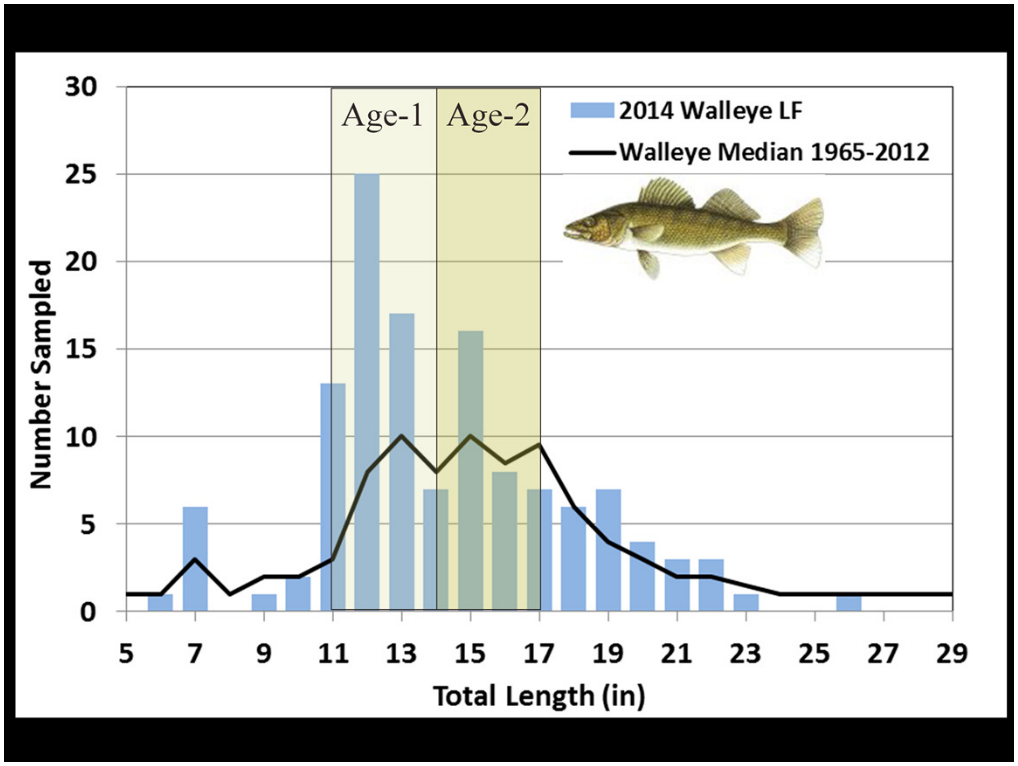
Group Questions

1. How many Walleyes will recruit to the catchable population on Pool 4 in 2015?

Length Group	Sample size	Subsample size	Age 0	1	2	3	4	5	6	
5.0 - 5.9	0	0								
6.0 - 6.9	1	1	1							
7.0 - 7.9	6	6	6							
8.0 - 8.9	0	0								
9.0 - 9.9	1	1	1							
10.0 - 10.9	2	2		2						
11.0 - 11.9	13	13		12	1					
12.0 - 12.9	25	24		25						
13.0 - 13.9	17	16		15	2					
14.0 - 14.9	7	7			7					
15.0 - 15.9	16	16			10	5	1			
16.0 - 16.9	8	8			4	4				
17.0 - 17.9	7	7			1	5	1			
18.0 - 18.9	6	6				5		1		
19.0 - 19.9	7	7				2	1	3		
20.0 - 20.9	4	4				1	1	1		
21.0 - 21.9	3	3				1	1	1		
22.0 - 22.9	3	3					1	2		
23.0 - 23.9	1	1						1		
24.0 - 24.9	0	0								
25.0 - 25.9	0	0								
26.0 - 26.9	1	1								1
Totals	128	126	8	54	25	23	6	9	0	3
Percent			6.3	42.1	19.6	18.0	4.7	7.0	0.0	2.3
	Mean Length (in)		7.6	12.4	15.2	17.6	19.4	20.9		22.2
	Standard Deviation		0.66	0.72	1.16	1.65	2.39	1.90		3.93
	Minimum Length (in)		6.7	10.6	11.9	15.5	15.9	18.4		19.3
	Maximum Length (in)		9.1	13.7	17.6	21.5	22.1	23.9		26.7



Because we can track relative changes in population size and the makeup of that population by age (the percent row under totals above) I can tell you that the Age-1 Walleyes we sampled in October 2014 with an average length of 12.4" made up 42.1% of the Walleyes we saw in our gillnets and correlate to the borderline strong year class from 2013. During 2015 those fish are going to grow to an average length of slightly over 15" by October 2015 (many will likely hit this mark by Mid July or early August) so I am fairly confident in saying that there will be many small Walleyes recruiting into the harvestable population in 2015 how well they bite is out of my control, but anglers will likely see good numbers of sublegal to barely legal fish in the spring with many more in the fall.



The shaded areas represent the portion of the catch that was the indicated age in the November 2014 gill nets. The left hand shaded area will be Age-2 in the spring of 2015 and should grow to fill the sizes encompassed by the right hand shaded area by the fall of 2015. Angler harvest and natural mortality will reduce the height of the bars as they move to the right, but given that the portion labeled Age-1 above is significantly higher than the median represented by the black line I would expect it to remain above average for 2015.

Group Questions

2. What is the purpose of stocking lakes that don't have the characteristics necessary for natural reproduction?
   a) Any purpose beyond sportfishing

Put & Take or Put, Grow, &Take fisheries are used for a number of different species.

1. Trout, Catfish, Walleye, Northern Pike – Kids Ponds, Farm Ponds, etc.
2. Walleye, Northern Pike – Lakes with poor reproductive potential
3. Wipers, Saugeye, Tiger Muskies – Stocking of sterile hybrids

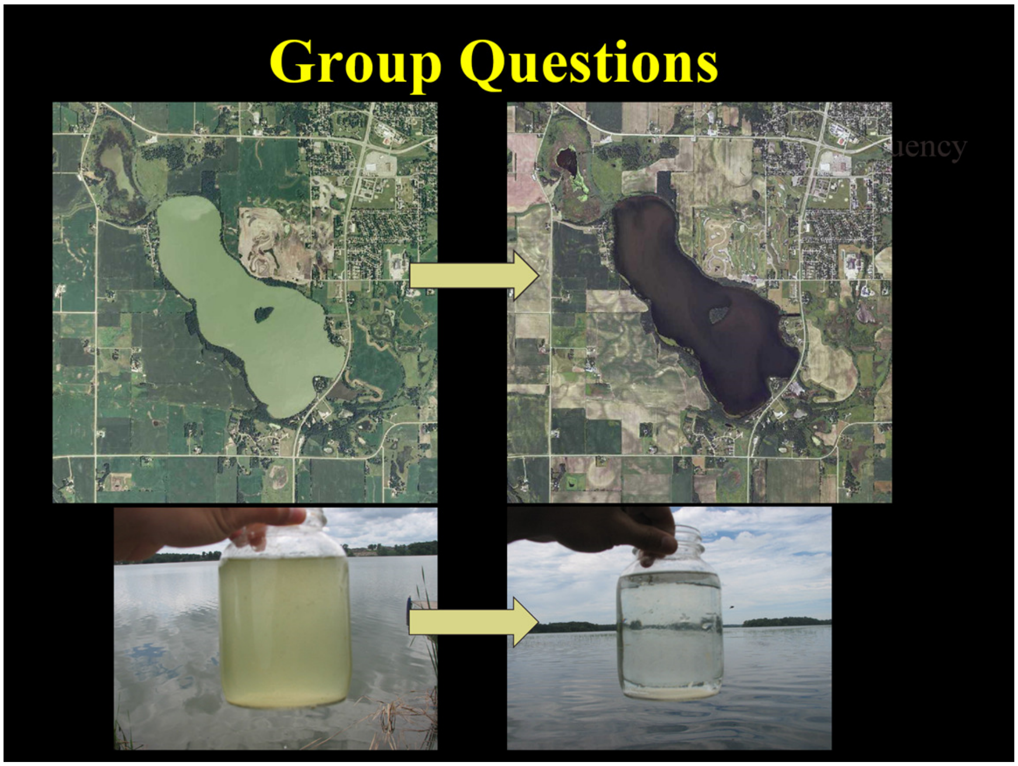
Stocking also used to establish/re-establish populations in a body of water: Muskie, Lake Sturgeon, etc.

Group Questions

2. What is the purpose of stocking lakes that don't have the characteristics necessary for natural reproduction?
   a) Any purpose beyond sportfishing

The primary non-sportfishing goals often revolve around control of other species typically via predation.

a) Flathead Catfish – control of Common Carp
b) Largemouth Bass – control stunted Bluegill
c) Walleye – control minnows and bullhead in shallow wildlife lakes

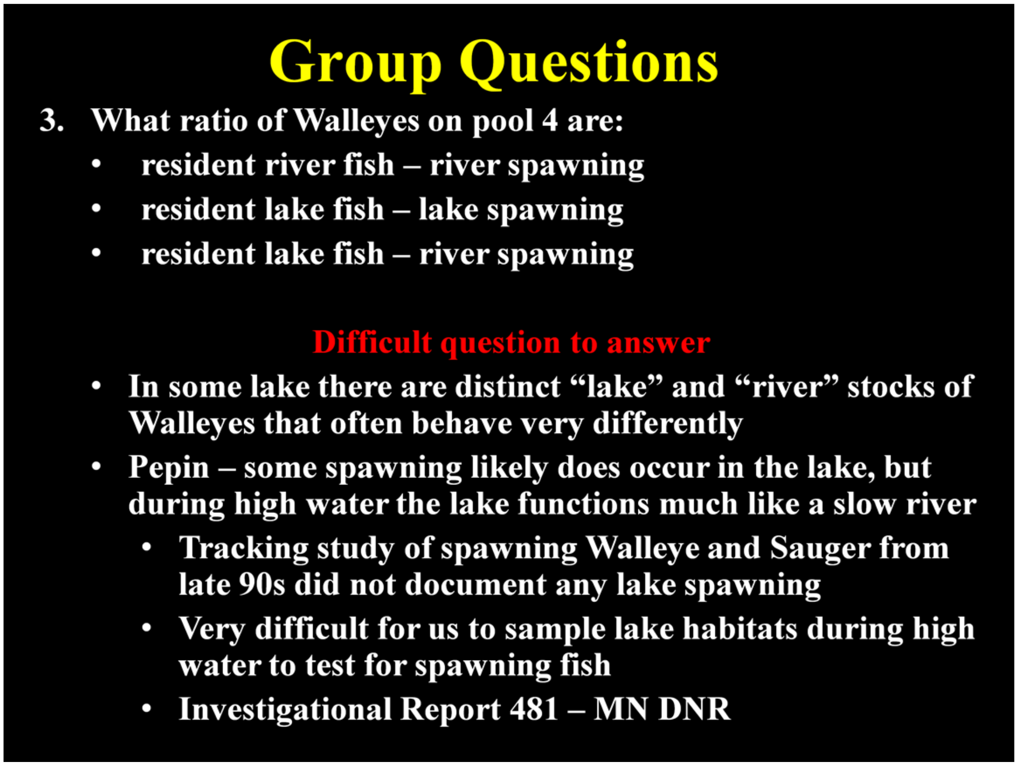


I could not find any photos of the shallow lakes where Walleye have been used as a control measure so Jerad Stricker of the Shell Rock River Watershed District was kind enough to let me use some of his photos from Pickerel Lake near Albert Lea. These lakes are part of a flowage and have been isolated from others by carp barriers, rotenoned (fish killed), and stocked with native fish including pike. The effects seen are similar to those expected from stocking Walleye in shallow lakes where shallow water and relatively high wind exposure combined with the high densities of Black Bullhead and various minnow species are responsible for re-suspending large amounts of sediment. The concept exhibited here is referred to as alternate stable states and in this case revolves around whether nutrient uptake is done primarily by aquatic plants (typically clear water) or phytoplankton (cloudy or green water).

The logic of alternate stable states as applied to shallow lakes is as follows:

1) A turbid (cloudy) or green (high phytoplankton and algae) stable state lake experiences low light penetration to the sediment and therefore little to no growth of submerged or emergent aquatic plants. Due to the lack of plants there is little to absorb and mitigate the wave action on the lake and waves re-suspend sediments from the lake bed or keep sediment rooted up by fish suspended longer. The result of suspended sediment is a feedback loop where the sediment provides more nutrients for algae/plankton growth and at the same time further limiting plants access to light.

2) A clear stable state lake experiences high light penetration to the sediment and therefore extensive growth of submerged or emergent aquatic plants. These plants then absorb the energy from wave action and help prevent re-suspension of sediments. In addition sediment that does get re-suspended due to wave action or fish activity tends to settle out in the still pockets around plant stems providing those plants with both more access to light (clear water) and nutrients from the deposited sediment thus completing another positive feedback loop opposite to that listed in example one.
3) Since each of the options described above are self re-enforcing feedback loops once a lake is in one state it is difficult to get it to switch. Large events like an extensive drought, change in land use causing increased sediment loading, or dramatic change in fish community can potentially “flip the switch” from one to another until another disruption to the community comes along.



The link to all of the MN DNR investigational reports is:

http://www.dnr.state.mn.us/publications/fisheries/investigational_reports.html

The link to MN DNR Investigational Report 481 – “Season Distribution, Habitat Use, and Spawning Locations of Walleye Stizostedion vitreum and Sauger S. canadense in Pool 4 of the Upper Mississippi River, with Special Emphasis on Winter Distribution Related to a Thermally Altered Environment” is:

http://files.dnr.state.mn.us/publications/fisheries/investigational_reports/481.pdf

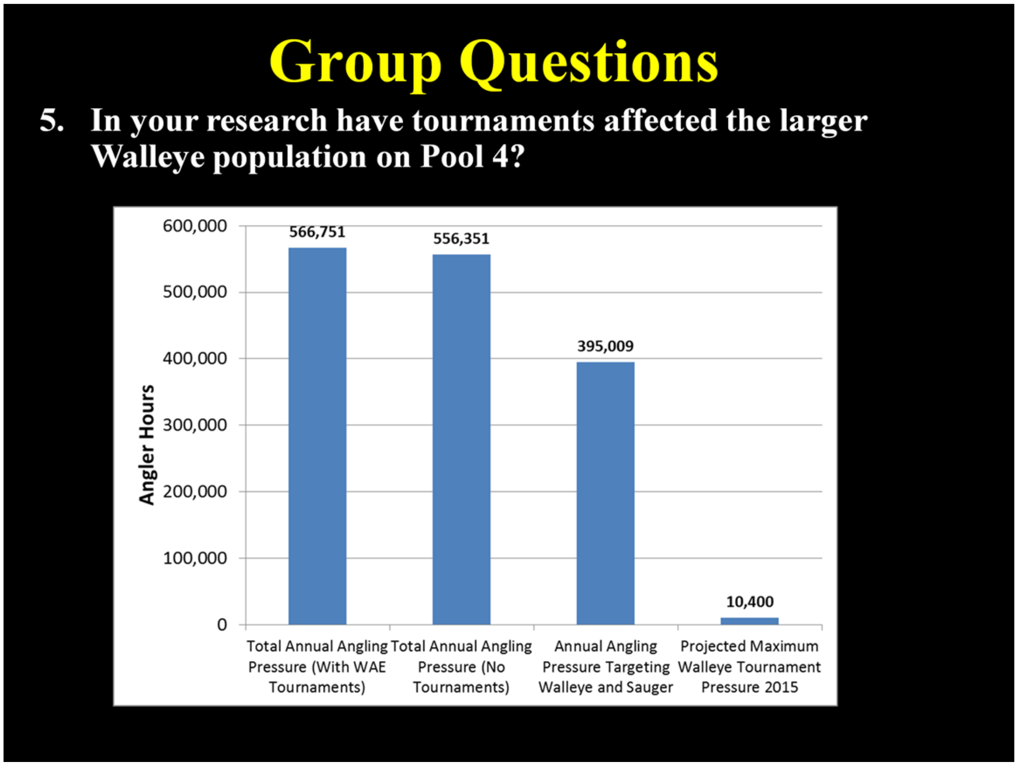
Group Questions

4. **What is the maximum temperature change Walleyes can tolerate?**

Small fish increased danger from short term thermal stress
Larger fish more susceptible to long term thermal stress

- **Optimal temp for Walleye and Sauger 71°-73°F**
- **Incipient Lethal temp for Walleye and Sauger is ~86°F**
  - **Temp at which 50% mortality is expected based on thermal stress**
- **Stress adds to these mortality rates and can be variable based on handling time, hooking injury etc.**
- **When stocking fish we typically use ±10°F as a general rule**

Note all the temps above are ranges or approximations to encompass both Walleye and Sauger.



In general no. While any pressure has some effect, we don't believe that tournament pressure is negatively affecting the Walleye population as a whole or the population of larger Walleyes on Pool 4. We do limit the numbers of tournaments that can be held on a body of water in a certain time period.

The most popular time for Walleye tournaments on Lake Pepin/Pool 4 is relatively early in spring when the rest of MN and neighboring states may have closed seasons. During this period water temperatures are typically low meaning generally low hooking mortality due to cool water and relatively shallow Walleyes.

The graph above helps to put the tournament pressure on Lake Pepin/Pool 4 in perspective.

- The first two columns show our estimates of angling pressure with and without Walleye tournaments respectively (the pressure is estimated from the average seen during the 2011-2013 Pool 4 Creel).
- The third column represents the portion of angling hours during our most recent creel that were spent annually targeting Walleye or Sauger based on interviews.
- The fourth column represents the Projected Maximum Walleye tournament pressure for 2015.
    - This was calculated by taking all scheduled Walleye tournaments assuming maximum permitted numbers of boats each with two anglers

fishing an 8 hour day.

- It also assumed that even if the tournament was for multiple pools ALL the pressure was applied to Pool 4

Group Questions

6. What are the ideal spawning conditions for Sauger and Walleye?
   a) How do they differ?

- Also addressed in Investigational Report 481 – MN DNR
- Walleye – 42°-50°F seem to prefer off channel flooded timber, bulrush, and reed-canary grass for spawning on Pool 4 when available
  - During low water years channel margins and cobble are also used
  - Benefit from continued high water to keep nursery habitat wet
- Sauger – 40°-50°F seem to prefer deeper channel margins and breaks often near wing dams
  - Benefit from high water with relatively rapid drop shortly after the spawn

http://files.dnr.state.mn.us/publications/fisheries/investigational_reports/481.pdf

This is a photo of the type of habitat that is found at the suspected Walleye spawning sites on Pool 4. Note flooded vegetation is clearly evident.