Slide 1
Information interpretation has become complicated.

Slide 2
[Outline for current presentation and two following presentations] The goal for today is to provide all information rather than just what is used in the Red Flags analysis.

Slide 3
Red Flags uses a selected group of variable for which we have data that indicates trends. This method has been used since 2005. Level 1 indicators (20-80 percentiles) show strong changes (yearly) and level 2 (40-60 percentile) show changes in last 3-5 years. Percentiles are often used for children - if my child is at the 50^{th} percentile, that is average.

Slide 4
In 2005 over 50% of the level 1 indicators were flagged and this resulted in stocking cuts in for 2006. Level 2 has been consistently over the 50% threshold since then which suggests that the system is changing rapidly. Level 1 seems to be a better indicator now. The Lake Michigan Committee was approached in 2008 when more than 50% of level 1 indicators were tripped - LMC response was that budgetary cuts of coho salmon would compensate for any other reductions in species at that time.

Slide 5
Each of the Red Flags indicators is plotted and we look at the changes through time. In the example here, Michigan weir returns have the level one trigger (20 to 80^{th} percentile) indicated by the blue zone. It triggers a flag indicating that there has been a significant change when if goes above or below the area. Level 2 is indicated by the green area.

Slide 6
In this case, data from 2010 would trigger Flag for both level 1 and level 2.

Slide 7
A wide variety of indicator are incorporated into the Red Flags table - Excel spreadsheet. Most of these indicators are not being presented because they will be in the Decisions Analysis presentation. And some Red Flags such as the Michigan vessel assessment have been discontinued due to budget constraints.

Slide 8
One of our indexes of abundance uses catch rates from reported charter fishing harvest. The mid-80s were a period of high success. The catch rates post 2005 are too high to sustain.

Slide 9
In 2010 there was an slight increase or stabilization in the percentage of anglers reaching the three fish bag limit.

Slide 10
There was also a slight increase in the catch rate.

Slide 11
2011 data is not fully analyzed but initial indications are that there is not much change in bag limits.

Slide 12

Or for catch rate.

Slide 13
In Michigan there is direct relationship between charter and regular sport angler creel. Charter angler catch rates are twice that of sport anglers. If charter goes up, so does sport angler. This slide represents Chinook salmon. We focus on Chinook since that is the best data set and Chinook are the most dependent on forage. There is a negative relationship with lake trout (regarding alewife) - as Chinook harvest increases, lake trout harvest declines.

Slide 14
Increasing weir returns indicate that abundance of Chinook salmon is still high. This also may be influenced by weather rather than strictly abundance. This may not tell us the whole story for natural recruits vs stocked fish because spawning is occurring is rivers without weirs.

Slide 15
A comparison of weir returns vs Illinois fall harbor electrofishing shows little correlation but data are still important. We try to include all data sources in the table.

Slide 16
These is the lakewide raw harvest numbers of Chinook in pounds since 1972, not corrected for effort.

Slide 17
[slide notes]

Slide 18
When we overlay the stocking efforts, you can see that as we increased stocking that the harvest went up. Then in the late 1980s, BKD reduced the population and angler harvests declined despite increased stocking efforts. Stocking was reduced. Now we see increased harvests but stocking has remained reduced. The may be the result of unaccounted natural reproduction.

Slide 19
This is Chinook stocking in all of the Great Lakes. In Michigan, we are currently stocking numbers similar to 1969 yet harvest is much higher.

Slide 20
The estimated recruitment of juvenile fish to system is represented by the yellow line. This includes our stocked fish (white line) plus the estimated natural recruitment (red). The natural recruitment comes from several studies that have been conducted through time. Most recently we have used the OTC study to estimate natural recruitment. The number of wild fish has increased through time.

We have now hit the carrying capacity at around 2-4 million smolts per year.

Slide 21
The OTC study is a lakewide coordinated study using a chemical in the food that leaves a mark on the bony structures of fish. Here, a vertebrae shows the light green mark that glows under black light. About 50% of the Chinook salmon in the lake are wild (natural rectuits). The increases that we see in the percentage of wild fish may be the result of fish moving into the lake from Lake Huron or a difference in survival rates between wild and stocked fish.

Slide 22
In 2011, all Chinook salmon stocked into Lake Michigan were marked with an adipose fin clip and implanted with a coded-wire tag (small, numbered piece of metal in head). This should give us a better estimate of natural recruitment.

Slide 23
We can answer several questions using this study.

Slide 24
We can also use the abundance of young-of-year alewife to predict Chinook salmon abundance since the two are related. However, there is high variability in the measure of alewife.

Slide 25
A new index is the number of eggs per female sampled at the weir. Here it is indicating a decline but that may be due to poor condition.

Question: Is there natural recruitment of other species besides Chinook?
Answer: Mostly that is not measured but it is negligible. No for lake trout and brown trout. May be little for coho and rainbow.

Question: Can license sales be used to track catch of sport anglers for areas not creeled?
Answer: Charter harvest is reported. Sport fishing catch and effort is similar to charter.

Slide 26
[slide notes]

Question: Can ports where fish are stocked be looked at for license sales because a cut in fish would result in decreased license sales?
Answer: We have looked at returns of stocked fish using the coded-wire tags in Michigan for the past few year. If stocking reductions are required then states will have to look at the distribution of fish within their own waters.