Lake Huron Management in Times of Change
August 2005

Michigan Department of Natural Resources
Fisheries Division

KEY POINTS

Issue: Chinook salmon fishery in Lake Huron is greatly reduced from past experiences.

- The alewife population and other prey items are at very low numbers in Lake Huron and uncertainty exists as to whether this due to major food-web shift as a result of exotic species or temporary condition of an imbalance between predators and prey
- Other fish populations such as walleye and lake trout are doing well.
- MDNR, with the support of the Lake Huron Citizen's Advisory Committee is recommending a 50% reduction in the number of Chinook salmon stocked in Lake Huron to try and restore balance in the Chinook salmon fishery.
- Monitoring of the lake will continue in addition to the development of new tools to evaluate the health and condition of the Lake Huron fish community.

BACKGROUND

The ups and downs of the Chinook salmon fishery in Lake Huron

In 2002, the Lake Huron Chinook salmon fishery experienced the highest Chinook salmon harvest since 1986. From data collected 1986 through 2004, the average catch rate range is 5-7 salmon per 100 hours of fishing. In 2002, the catch rate for Chinook salmon increased to 9 fish/100 hours and was the highest catch rate since Fisheries Division began recording this data in 1986. Unfortunately, a large change was looming following this very satisfactory year of fishing. In 2003, anglers began noticing a change in the geographical distribution and body size of salmon in Lake Huron. The creel survey confirmed a reduction to 7 fish/100 hrs in 2003 and 5 fish/100 hrs in 2004. Angler reports indicate that this trend is continuing in 2005. At the same time that lower catch rates were reported, assessments of the fishery conducted by Michigan Department of Natural Resources (MDNR) and partner agencies, including U.S.G.S. Great Lakes Science Center (USGS-GLSC), U. S. Fish and Wildlife Service (USFWS), Ontario Ministry of Natural Resources (OMNR), and the Chippewa-Ottawa Resource Authority (CORA), indicated changes in the condition and size of Chinook salmon and lake trout in the lake. These changes occurred in spite of no changes to stocking rates, locations, or methods for Lake Huron.

Why is the fishery so different today than in 2002?

Several factors lined up to create the "perfect storm" for current conditions in Lake Huron. One of these factors alone would not be expected to lead to major changes in the fishery, but in combination they provided the catalyst for a large change. These factors include a decline in alewife abundance, other invasive species, and increased predation on prey fish species in the lake.

Decline in Alewife

Alewife, smelt, bloaters, sculpin, sticklebacks, and most recently gobies are the main fish species used as food items by Chinook salmon in Lake Huron. These food items are also called forage, baitfish, or prey. In 2003 and 2004, samples collected by USGS-GLSC showed that the forage in Lake Huron was

reduced to 35-50% of the average values (1992- 2004). In the past, a similarly low value was also observed in 1998, but this was followed by 4 years of average to higher than average values in numbers of prey species in Lake Huron.

Alewives are not native to the Great lakes. Over the years, alewife have eliminated or reduced many of the native prey species in the lake. Because alewfie are not native to the Great Lakes, they are sensitive to cold winters and their populations can fluctuate widely and quickly as a result of lower survival from environmental factors. Chinook salmon primarily feed on alewife and are not very good at switching to other types of available forage.

In 2002, there was nothing particularly unusual about the numbers of adult and age-0 alewife captured in the trawl by USGS-GLSC. However, a dramatic shift was noted in the number of adult alewife and the number of age-0 alewife by 2003. Numbers of adults were unusually low likely due to the very harsh winter in 2002 to 2003 while the numbers of age-0 alewife were unusually large. This was not a cause for immediate concern because similarly low numbers of alewife had been observed in 1998. Additionally, it was expected that the large number of age-0 alewife would survive to the next year and make up for the low number of adults. Scientific evidence suggests, however, that alewife must reach at least 3.2 inches long to survive through winter, which did not happen in 2003 since the young alewife did not grow well during the summer months. Thus, these fish did not survive in large enough numbers to provide the anticipated forage base in 2004. Fall surveys in 2004 confirmed historical low numbers of adult and age-0 alewife in Lake Huron.

Often a gap in the fish community such as the one left by alewives makes resources available to other species that then fill the void. In the past, the Lake Huron fishery has subsisted with a forage base dominated by smelt. In 2003 and 2004, however, no species increased in abundance to fill the niche left by alewives. In 2004, there was an increase in the abundance of smelt, bloaters, and lake herring, but the overall weight of all species combined (also referred to as biomass) for these fish is still below average.

Other Invasive Species

Some scientists suggest that a major shift in the food web and thus location of available nutrients is occurring in Lake Huron. Most of the invasive species such as gobies, zebra mussels, and quagga mussels, reside at the bottom or “benthic” layer of the lake. When these invasive organisms persist at very high abundances at the bottom, a large amount of the nutrients that supply the food web is tied up at the bottom. Many of the species that are native to the Great Lakes rely on food items being available up in the water column rather than on the bottom of the lake.

Diporeia, a native shrimp-like crustacean, is an important food source that is disappearing throughout Lake Huron. Diporeia are food for other fish such as alewives that are forage for other predators. Diporeia feed on the bottom and then migrate up in the water column where they are available as forage for young fish and whitefish. In the past, this pattern recycled nutrients from the bottom of the lake and made them available to fish in the water column in the form of a food item. With the disappearance of this organism, whitefish are smaller and skinnier. This is another example of a large shift in the lake food web dynamics.

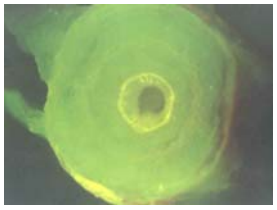
Zebra mussels, and now quagga mussels, have a large presence in Lake Huron and researchers suspect that these species play a large role in the disappearance of Diporeia throughout the Great Lakes.

Since 1998, round gobies have more than doubled each year in the sampling trawls, until 2004 when they too declined. Native species such as the slimy sculpin and johhny darter are greatly reduced in Lake Huron possibly as a result of the increased abundance of gobies.

More predators than prey…a system out of balance

Increased survival of lake trout and natural reproduction of Chinook salmon may have led to increased predation rates in Lake Huron. As a result of the 2000 Consent Decree, thousands of feet of gill net in the commercial fishery have been replaced by trap nets. The use of trap nets increases the survival of all fish caught as bycatch in the target commercial fishery. Lake trout survival has increased as a result of this change in gear, leading to a greater number of adult lake trout throughout Lake Huron. Furthermore, the St. Marys River was treated for sea lamprey, resulting in tremendous success and a reduction in lamprey wounding by 58% since 2001, which also led to increased numbers of lake trout in Lake Huron.

In 2000, Fisheries Division began a study with the cooperation of Ontario to mark all of the Chinook salmon stocked in Lake Huron. The objective of this study was to confirm an assumption that 15% of the Chinook salmon present in the fishery reproduced in the wild. This information was for use in a predictive model to estimate total consumption of forage by the number of predators present in the lake. The intended use of this model is for guiding management of Lake Huron to achieve balance and sustainability of the fisheries. Initial findings of this study showed surprisingly that 85% of the Chinook salmon harvested by the sport fishery were wild fish rather than hatchery fish! While the total abundance of Chinook salmon in Lake Huron is unknown, this large proportion of wild fish in the harvest may suggest that a large amount of natural reproduction of juvenile Chinook salmon occurred and could have surpassed the number of Chinook salmon stocked in Lake Huron. Current stocking targets for Chinook salmon are 2.8 million annually for Michigan, and 600,000 for Ontario through their volunteer hatchery program.



To summarize, just at the time it appeared that a shift was occurring in the food web in the lake, there may also have been an increase in the number of Chinook salmon in the lake and therefore in the rate of predation on forage species to feed all the salmon. Other factors outlined below demonstrate that there is a shortage of forage in the lake for the current Chinook salmon population.

Development of "Red Flags" to Guide Management of the Lake Huron Fishery

Similar to Lake Michigan, scientists working on Lake Huron have developed a series of indicators or "red flags" to use as a scientific measure of the health of Chinook salmon populations and the fishery. These flags include: Harvest, Index of abundance, Reproduction, Growth, Forage abundance, Fish health, and Age composition. Essentially, these are multiple lines of evidence to help us diagnose the health of the lake fishery, but these data do include levels of uncertainty. The current status of each flag is defined below in terms of red (warning), yellow (caution), or green (no concern at this time). Average values (plus and minus a margin of error) are presented to reference the current conditions with those observed in the past.

1. Harvest (Red). In 1997 and again in 2002, large increases in angler catch rate above the average values were observed. This unexplained increase is a potential indicator of increased vulnerability to the gear as hungry fish will bite lures more readily. An increased catch rate may also indicate increased abundance. Based on data collected from 1986 through 2004, an average catch rate range is 5-7 fish/ 100 hours. In 2002, the sport fishery for Chinook salmon on Lake Huron

experienced the highest Chinook salmon catch rate since the beginning of the State's creel survey, averaging 9 fish/100 hours.

2. Index of abundance (Red?). MDNR does not currently have a fishery independent survey to assess total abundance of Chinook salmon in the lake, and angler catch rates are not always reliable estimates of abundance in the lake. Rate of return to the Swan Weir, where broodstock are collected for eggs, has been about 1.5% of the number of fish stocked during 1999-2003 In 2004, return rates declined to 0.9% indicating a decline in survival of stocked fish, but this may also indicate a possible decline in the numbers of Chinook salmon in Lake Huron if wild fish also experienced a decline in their survival.

   At the same time, the study of wild produced versus hatchery produced fish showed that only 15% of the Chinook salmon in the lake were hatchery fish. The conclusion from this is that there are more wild fish in the lake than hatchery fish, but total abundance of Chinook salmon available to the fishery is really unknown.

3. Reproduction of wild Chinook salmon (Red). A recent study has shown that about 85% of the fish harvested from Lake Huron are wild fish. Use of this information with the known number of fish stocked, leads to an estimation of 10 million or more age-0 salmon entering the system and that means about 8 million of those are wild fish! When 50% or more of the Chinook salmon in 3 out of 5 consecutive years are wild produced fish, it may be detrimental to continue to stock on top of the wild fish population. The detriment comes when the predators begin to outnumber the amount that can be supported by the prey base.

4. Growth (Red). Weight at age can be used as an indication of fish growth when compared among years. Age 2 Chinook salmon have averaged about 7.5 (± 0.6) lbs since 1986. In 2003, age-2 Chinook salmon averaged 5.4 lbs, which is similar to observations from 1997 (5.6 lbs) and 1998 (4.8 lbs). Age-3 Chinook salmon have averaged 14.3 (± 0.9) lbs since 1986. In 2003, an average of 11.3 lbs was observed, which is also similar to weights at age-3 observed in 1997 (12.5 lbs) and 1998 (9.5 lbs).

5. Forage abundance (Red). When measuring prey abundance, it is important to consider the total abundance of the prey items as well as the ability for prey species to 1) sustain their population into the future and 2) the diversity of prey species so that multiple types of forage are present and the decline of one doesn't result in a total collapse of forage. Total biomass or weight of all prey items averaged about 535 (± 122) lbs per sample taken from Lake Huron during 1992-2004. In 2004, total biomass declined to 232 lbs per sample, which is the lowest amount recorded for Lake Huron during the time period but was similar to the estimate of biomass in 1998 at 276 lbs per sample. In addition to alewife and smelt, other forage species in the trawl are bloater, gobies, sticklebacks, sculpins, and trout-perch.

   Alewife and smelt are the preferred food items in the diets of Chinook salmon. The number of alewife per trawl sample from Lake Huron averaged about 1,790 (± 792) fish per sample in 1992-2002. In 2003, the number sampled increased by 4 times to 7,900 alewife per sample. This high number was the result of significant reproduction and the majority of fish in the samples were age-0. By fall 2004, the number dropped to only 16 alewife per sample. In the past, the numbers of alewife were also low in 1992 (500 fish per sample), 1993 (400 fish per sample) and 1997 (800 fish per sample). In 2002, alewife up to 5 years old were found in the samples. By 2004, however, the greatest abundance of alewife captured were age-0 fish, thus with few adults remaining, alewife are not likely to experience a rapid population increase.

Smelt averaged around 1,663 (± 470) fish per sample in 1992-2004. Recently, an average number of smelt were present in 2002 (1,600 fish per sample) and above average in 2003 (2,550 fish per sample). In 1997, smelt numbers were also above average (1,800 fish per sample) when alewife were significantly reduced. Smelt appear to be increasing in the number of ages that are captured in the samples.

7. Fish health (Red). Fish health can be monitored by measuring disease as well as the "condition" or robustness of individual fish. A fish's condition is determined from a relationship between the length and weight of an individual fish. A fish that is in good condition has an index value of 1 or better. A condition index value of 0.7 or less is likely a level at which the fish will die. From 1986 to 2003, Chinook salmon in Lake Huron had an average condition index value of 1.04 (± 0.03). When alewife abundance was low in 1997 and 1998, condition index values of 0.96 and 0.90 were observed. Thus, it is not surprising to see values of 0.99 in 2002 and 0.92 in 2003, indicating that on average Chinook salmon are skinnier than normal.

   When salmon return to the spawning weirs in fall, observations are made to record the incidence of bacterial kidney disease (BKD) in the fish. In 1997 there was an increase in BKD in Chinook salmon returning from Lake Huron, when 5% of the fish that returned to the Swan Weir were BKD positive. Since 1998, levels have remained steady between 1% and 3%. In 2004, the incidence of BKD was measured at 2%.

   So, while fish condition index values are lower than average, there does not appear to be an increase in the level of BKD observed in Chinook salmon.

8. Age composition. When measuring characteristics of a fish population, a healthy population has several year classes up to the known length of the life of the species. Chinook salmon have short lives and die after spawning. It is unusual to see a Chinook salmon older than age 5 and more typical to see a small proportion of age-1 fish that are mature, with the majority of mature fish made up by 2-, 3-, and 4-year-old fish. On average (1988-2003), the mature Chinook salmon population is distributed as 12% age 1, 30% age 2, 39% age 3, and 15% ages 4 and 5 in the recreational harvest from Lake Huron. In 2003 50% of the mature fish were age 2, while 48% were age 3 and only 1.5% were ages 4 and 5. Clearly it appears there are year classes missing both in the youngest and oldest categories.

These multiple lines of evidence show a preponderance of information that suggests management action is warranted to hopefully restore Chinook salmon stocks and avoid potential disease outbreaks, and in turn bring the Chinook salmon fishery back to reasonable levels in Lake Huron. Similar conditions were observed in 1997 and 1998 which resulted in a management action of a 20% reduction in the number of Chinook salmon stocked in Lake Huron.

What about other species in the lake?

The news for Lake Huron is not all bad! Fisheries Division seeks to provide a diverse fishery in Lake Huron to address the variability that is known to occur in all ecosystems. Some years (or series of years) simply favor one species over another, whether the species is produced in the wild or stocked each year. Some of the information collected on other species in Lake Huron indicate:

- Lake trout are providing a tremendous fishery, particularly in the southern basin. There is also evidence of natural reproduction occurring by lake trout. Lake trout are doing better than Chinook salmon because they utilize a broader range of habitat types and thus adapt more easily to

eating different types of prey. They are even found to have gobies in their diet!

- Walleye are reproducing in larger numbers than observed in recent history.
- Yellow perch are also, for the first time in a long time, producing large numbers of young. These young provide the potential for future year classes and also provide additional forage when their year classes are large. This is similar to how the lake operated prior to the alewife invasion.
- Coho salmon, which are not stocked in Lake Huron, provided high catch rates in 2002 and anglers report that they occurred again in the fishery in spring 2005. The origin of these fish is unknown, but they could be migrants from Lake Michigan or fish that are naturally reproducing in the Lake Huron basin.
- Lake herring are a native species that might fill the niche left by alewife. Herring could provide forage for Chinook salmon and at the same time provide an additional fishing opportunity. Herring populations are known to occur in the northern part of Lake Huron and on the Canadian side. Evidence suggests that these populations may be expanding. Because herring are native, they would provide a more stable forage base for the lake than alewife.
- Natural reproduction of Chinook salmon is a sign of good habitat in rivers!

Management of Lake Huron

The Lake Huron fishery is managed through a cooperative process called "A Joint Strategic Plan for Management of the Great Lakes Fisheries" (Great Lakes Fishery Commission 1980, revised 1997). This plan, which was developed by fishery management agencies in the Great Lakes basin, outlines the goal of creating stable, self-sustaining stocks that are supplemented by stocking hatchery fish with the objective of providing food for people, recreational opportunities, employment and income, and a healthy human environment. This umbrella goal guides the direction of management in the lake and has been agreed to by the fishery management agencies for Lake Huron, including MDNR, OMNR, and CORA.

Three key ecological concepts must be achieved when managing fish populations: stability, balance, and sustainability. Stability refers to the ability of fish species to maintain their population levels in the face of possible invaders, ecological or environmental disturbance, and to recover quickly from a disturbance. Balance refers to the ability of the food chain to produce an appropriate ratio of predators to prey. Too many predators will result in an unhealthy predator population (ranging from small fish to skinny or diseased fish) and too much prey can often result in nuisance conditions, such as when there were too many alewife in the lake. The third concept of sustainability looks to the long-term desirable outcomes from fish populations to provide fisheries that meet the demands of society today and in the future. Habitat degradation must be minimized to support long term sustainability of fish stocks as well as recognizing that high cost/low return stocking programs are not economically sustainable.

Guiding Management Principles for Lake Huron (Desjardine et al. 1995) include the following:

- Lake Huron must be recognized as a whole ecosystem and interrelationships with other habitats recognized.
- Habitat preservation and restoration must be recognized in this ecosystem approach and humans and human impacts are part of this system.
- Naturally reproducing fish populations (native and naturalized) provide sustainable benefits with minimal long term cost to society.
- Stocked fish are recognized as an integral part of the system as a rehabilitation tool, maintaining biological integrity of the fish community, and for providing fishing opportunities.

- Species diversity contributes to balance and stability of the fish community.
- Rare and endangered native species should be recognized for their ecological significance and intrinsic value and protected accordingly.
- Genetic diversity is important to overall species fitness and adaptability.
- Socioeconomic values (recreation and commercial fishing interests) are a priority in making management decisions.
- Fisheries are part of the cultural heritage.
- Good management is based on the best available scientific knowledge, including social values.

The overall objective for Lake Huron as outlined in the Fish Community Objectives (Desjardine et al. 1995) is to ***restore an ecologically balanced fish community dominated by top predators and consisting largely of self-sustaining native and naturalized species.*** The main top predators in Lake Huron include lake trout, Chinook salmon, walleye, burbot, brown trout, and steelhead.

Specifically, the objectives for salmon and trout are to establish stocks capable of providing a fishery by 2015 in which lake trout are the dominant species while salmon and steelhead have a prominent place in the fishery. This goal is directed towards the balance and sustainability concepts outlined above and was agreed upon through a public review process in 1995. Because lake trout are a long-lived species that evolved in the Great Lakes, they are more likely to provide the balance and long-term sustainability in the predator base. However, salmon and steelhead are also recognized for their ability to help achieve balance in the face of burgeoning alewife populations and they are recognized for their high social value. The goals of MDNR for stocking Chinook salmon are to produce sustainable and stable populations that:

- diversify and enhance the lake fishery,
- provide for a return fishery at selected locations,
- establish a brood stock return location, and
- control the alewife population.

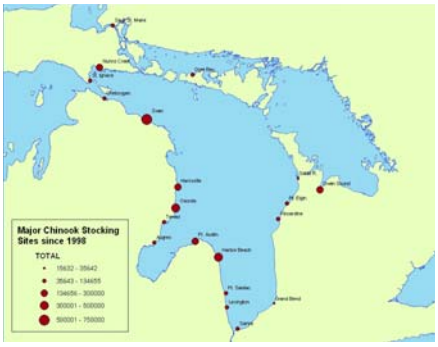
One year of unusual or below average conditions does not constitute a trend. Thus, responding in 2004 to conditions in 2003 could have been premature given the other conditions in the lake. Evidence, as outlined by the red flags indicators, now suggests that a major shift in the ecology of the lake is occurring rather than a low point that could have been considered to be natural variability. The results from the 2004 monitoring surveys reflected patterns similar to those observed in 2003, and preliminary reports from anglers and others indicate that 2005 is following the trends predicted last year. It is the job of professional fishery managers to make sure that management actions are prudent and that thoughtful responses to changes observed in the lake are implemented.

Management Recommendations for Lake Huron

Given the state of the forage base in Lake Huron and the biological evidence gathered from Chinook salmon, a reduction in stocking of Chinook salmon is warranted to attempt to restore balance in the population and thus the fishery. In determining the details of such a reduction, the following must be recognize:

- in most cases, net pens may provide a greater return than traditional stocking practices for Chinook salmon;
- evidence of natural reproduction occurs at several locations and stocking may actually be disadvantageous in those areas;

- a return of salmon to provide broodstock should be maintained at the Swan Weir (Presque Isle County); and
- natural reproduction of Chinook salmon could be sufficient to support the open water fishery while stocking is most advantageous to sustain return fisheries.



A reduction of 50% of the total number of Chinook salmon stocked in Lake Huron is recommended for providing a measurable response in the fish community. The stocking level targeted by Michigan for Lake Huron is 2.85 million fish and a reduction would lead to a new target of about 1.43 million. Evidence suggests that stocking could be eliminated at St. Ignace (80,000 fish), the St. Marys River (80,000 fish), and Au Gres (60,000 fish). Natural reproduction is known to occur in the Carp River near the St. Ignace stocking location and in the Garden River and St. Marys River. The Au Gres location is producing large numbers of walleye and the Chinook salmon fishery in this area has never been very good, likely due to predation by walleye. The remaining balance results in an approximate 46% reduction distributed over the other stocking locations.

Fisheries Division recommends implementing the proposed stocking reduction plan in 2006, and lasting for five years until 2011. Throughout this time, monitoring will continue and MDNR will report back to stakeholders again in a large public forum soon after the five years have elapsed. It is necessary to implement this management action over a long time period to effectively realize and measure results. Changes made today in management will be observed in 2-3 years when these fish recruit into the fishery. Time lags such as this are inherent in any natural resource management action and are dependent on the life cycles and generation times of the target species.

Areas of Uncertainty

The management recommendation posed was developed with consideration of information or trends that are not predictable. The following outlines some of these areas of uncertainty for consideration as the plan is moved forward into the public process.

- The time to recovery or increase in abundance of forage species is uncertain. If the situation in the lake is one of an imbalance in the predator-prey ratio, recovery could be quicker than if the entire lake is experiencing a large food-web shift. It is uncertain which of these two conditions are occurring in Lake Huron at this time.
- The abundance and availability of forage is difficult to predict in the future. Thus, while it is believed today that the lake is presented with an unprecedented decline in forage, mild environmental conditions could result in conditions favorable for survival of prey species. Conversely, multiple years of adverse environmental conditions could lead to continued suppression of prey species.
- Observations reveal that 85% of Chinook salmon harvested are wild fish. However, the total abundance of Chinook salmon in the lake is unknown and it is also unknown if natural reproduction is going to be persistent or simply an occasional trend. Gross estimates suggest that very large numbers of wild juveniles are produced in the tributaries and these numbers are possibly up to 4 times greater than the number stocked. If this is true, then the relatively small number of Chinook salmon stocked may not be influencing the dynamics of fish stocks inhabiting Lake Huron. Natural corrections do occur in wild brood stocks and survival of young fish, and thus it is prudent for adjustments to be made in stocking practices to allow recovery of Chinook salmon stocks to occur naturally. If a reduction is not made, the potential risk is for a more prolonged natural correction towards predator-prey balance.

- It is always a goal to improve effectiveness of stocking. To stock fish when there are already so many in the lake is wasteful of license dollars and is ethically questioned by professional fish managers. If the numbers stocked are reduced, a better opportunity exists for those fish that are stocked to survive.

Is a 50% reduction in Chinook salmon stocking the only option?

Other potential options for managing the Lake Huron fishery include making no changes and continuing to stock at current levels, cutting stocking at all locations except for the Swan Weir, or reducing either more or less than 50%. The following defines the risks, pros, and cons with each option.

No change option. The risk in making no change to current stocking levels is that the Chinook salmon population is stressed and the longer these conditions prevail, the more likely it is that a disease outbreak will occur. Furthermore, the longer the system receives a high number of predators, the longer it will potentially take for recovery to occur. Persistent conditions in the lake suggest that a positive turn around is not imminent for Chinook salmon stocks.

Discontinue stocking Chinook salmon at all locations except for Swan Weir. Maintaining the broodstock at Swan Weir is desired to continue with the Chinook salmon program for Lake Huron. Fisheries Division has concerns that if stocking were reduced completely at all other locations in Lake Huron, return of Chinook salmon at ports where wild fish are not known to reproduce could lead to a collapse of those fisheries with significant social and economic consequences. This could effectively make the fishery available only in the open water areas of the lake, thus excluding a large segment of the angling public such as pier, river, and shore anglers from having access to the fishery.

Reduce stocking at something less than 50%. The best science indicates that any reduction less than 50% will likely not produce measurable results because of the natural variability in the data that has been collected. It is also clear that the “red flags” are suggesting a strong need for implementing a measurable reduction. The signs of reduced fish condition and lowered survival are not subtle! Thus, anything less than 50% will likely not produce measurable results in fish quality or survival.

Reduce stocking at something greater than 50%. It is likely that a reduction greater than 50% could produce a better quality fish and increase survival of Chinook salmon. It is uncertain, however, whether the magnitude of these benefits outweighs the negatives, including the preservation of sport fisheries targeting Chinook salmon returning to spawn in the fall.

What about future management of Lake Huron?

There are several tools in place to continue monitoring the health and quality of Chinook salmon stocks and the fishery that results in Lake Huron. DNR is continually working with partner agencies to refine these tools, which provide information necessary to effectively and efficiently manage Chinook salmon stocks in Lake Huron. Current assessment tools include:

- fish population surveys;
- creel assessment;
- partnership commitments for assessing forage abundance; and
- public participation and stewardship.

As new information is obtained from current survey techniques, additional tools are being developed and refined in collaboration with partner agencies, including:

- a decision support model to look at future management options;
- more sensitive measures for estimating changes in energy balance;
- continued marking studies to estimate numbers of hatchery versus wild Chinook salmon, as well as accurate aging and growth information; and
- determining the ration size of Chinook salmon and their consumption of forage.

Ration can be defined as the amount in weight of forage consumed on average by each age of fish. This will lead to modified predator consumption values for the lake.

For the future management of Lake Huron, there are additional needs that will enable better monitoring and decision making. These needs include:

- financial and political support for research and evaluation programs;
- mass marking of all salmon and trout stocked in the Great Lakes Basin to allow for more accurate detection of natural reproduction, and for determining total abundance of each species in the lake;
- continued vigilance and effort towards understanding effects of exotic species on the ecosystem and control for preventing future introductions; and
- patience and understanding of stakeholders as the lake ecosystem moves in new directions.

These tools and support needs will allow for evaluation of future management strategies for Lake Huron that may involve further reductions of stocking if necessary, or even increases in stocking if information and evidence support such an action.

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References

DesJardine, R. L., T. K. Gorenflo, R. N. Payne, J. D. Schrouder. 1995. Fish-community objectives for Lake Huron. Great Lakes Fish. Comm. Spec. Pub. 95-1. 38 p. (http://www.glfc.org/pubs/SpecialPubs/Sp95_2.pdf)

GLFC (Great Lakes Fishery Commission). 1997. A Joint Strategic Plan for Management of Great Lakes Fisheries*. Ann Arbor, MI. (http://www.glfc.org/fishmgmt/jsp97.htm)*