Lake Michigan Salmon Stocking

Frequently Asked Questions

Michigan Department of Natural Resources, Fisheries Division

Developed: March 2014

1. **How are fisheries management decisions made for the Great Lakes?**
   Individual state or provincial agencies are responsible for managing fisheries within their state boundaries and each jurisdiction has their own decision making process. However, all states and provinces that border a Great Lake are signatory to the Joint Strategic Plan for Management of Great Lakes Fisheries and have collaboratively developed Fish Community Objectives for each of the Great Lakes through their individual Lake Committees.

   Management agencies work together through the Lake Committee process to assure that Great Lake management actions are communicated and discussed among the state and provincial jurisdictions. The Lake Michigan Committee (LMC) has the following members on it: one representative from Michigan, Wisconsin, Illinois, and Indiana, and one representative from the Chippewa-Ottawa Resource Authority.

2. **How were the 2013 Chinook salmon stocking cuts determined?**
   The LMC, comprised of state and tribal natural resource agencies in the Lake Michigan basin, facilitated a structured decision making process that involved input and expertise from diverse stakeholders, pertinent scientific information and modeling, and a comprehensive evaluation component to discuss and determine a stocking management and evaluation plan.
   - A core stakeholder group consisting of angling group representatives from Illinois, Indiana, Wisconsin and Michigan was formed in 2011 to provide the LMC with lakewide stakeholder goals and objectives and stocking options based on historic and current survey information and population level modeling efforts.
   - The LMC and stakeholder group reviewed 26 stocking options to meet stakeholder and agency lake-wide goals. Based on their input, the LMC recommended further review of 4 stocking options in 2012.
   - These options were reviewed by the Lake Michigan Citizen Fishery Advisory Committee and the general public.
   - Based on the input received, the LMC decided to reduce Chinook salmon stocking lake-wide by 50% and adopt a feedback policy whereby future stocking changes, increase or decrease, are influenced strongly by a biological index of predator-prey levels. Until such time that the LMC can develop a comprehensive predator-prey index to be used as the feedback policy, the LMC will use a three year average weight of age-3 female Chinook salmon returning to the Strawberry Creek weir in Wisconsin from 2013-2015. If the three year average weight of an age-3 female Chinook salmon is below 7kg (15.4 lbs) then addition reductions in stocking should be considered and if it is above 9kg (19.8 lbs) then an increase in stocking should be considered. Stocking numbers would remain if the three year average weight is between 7 and 9kg.

3. **Chinook salmon stocking was cut by 50% lakewide (67% in Michigan waters) in 2013. Will further Chinook salmon stocking cuts take place in 2014?**
   Lake Michigan Chinook salmon stocking levels will remain the same as in 2013, meaning no further cuts will take place in 2014.

4. **Why did Michigan take a larger cut percentage-wise than other states?**
   The reason for this is because many Michigan rivers produce lots of wild, naturally reproduced Chinook salmon and have large runs based entirely on natural reproduction. There is very little Chinook salmon natural reproduction in the rivers of other states bordering Lake Michigan.

5. **There seemed to be fewer, but larger, Chinook salmon in Lake Michigan in 2013. Did the 2013 stocking cuts cause this?**
   No, most of the Chinook caught by anglers in 2013 were age-3 fish from the 2010 year class. Fish stocked in 2013 will begin to be caught by anglers in 2014 as age-1 fish. The reason anglers observed fewer, but larger fish is based on the survival of Chinook salmon year classes as a result of the alewife year class production in the same year. In 2010, there was a large year class of alewife produced which increased Chinook salmon survival and numbers for that year class substantially. In 2011, however, the alewife production was very low resulting in a low number of 2011 salmon and still a high number of 2010 (age-1 Chinook). This pattern played out in 2012 with a record high number of age-2 Chinook salmon in the fishery, but not huge in size. In 2013, the remaining Chinook salmon from the 2010 year class (e.g., the fish that didn't mature and die in 2011 or 2012) had an abundant supply of food and little competition from other salmon year classes resulting in lower catch rates but really big fish. Poor weather and lake conditions also contributed to the lower Chinook salmon catch of 2013. It is also important to note that even though returns were down, they were not at historical lows.

6. **What was the weight of age-3 female Chinook salmon in 2013?**
   The 2013 female weight at age-3 Chinook salmon from the Strawberry Creek Weir in Wisconsin was 8.74 kg (19.27 lbs).

7. **There seems to be a lot of forage in the lake right now, and most Chinook salmon appear large and healthy. If the Chinook salmon have enough to eat and are growing well, shouldn't we consider increased stocking rates?**
   One of the driving forces contributing to the short and long term sustainability of the Chinook salmon fishery is a balanced predator prey relationship. We know Chinook salmon feed primarily on alewives. We also know that in a healthy alewife population, we would expect to see a large number of age classes. Building on the explanation in #5 above, we estimate the 2012 alewife year class was slightly above average and that the 2013 alewife year class was well below average. Therefore, we are expecting catch rates to increase in 2014 (not as much as in 2012) because the 2012 Chinook salmon year class will recruit to the fishery. However, we also expect catch rates to decline in 2015, possibly lower than 2013, and size to increase (again, not as large as in 2013).

   In 2007 management agencies observed nine different alewife age-classes in the lake, while in 2012 only four age-classes were observed and the vast majority of them were young fish (age 2 and age 0). Fewer age classes and large alewives were also observed prior to the alewife collapse, and subsequent Chinook salmon collapse in Lake Huron. Additional stocking of Chinook salmon in Lake Michigan would increase predator prey unbalance and risk a potential fishery collapse at this time.

8. **What are the results of the 2013 prey fish trawl and acoustic surveys used to detect alewives?**
   Preliminary acoustic survey results suggest that the 2013 alewife year class was low in abundance and the length of these young-of-the-year fish was relatively low (<2.4 in). Based on the low abundance and small size, survival of the 2013 alewife year class to age-1 will likely be low. The alewife population in Lake Michigan is now made up almost entirely of just two year classes – 2010 and 2012.

9. **I mark a lot of baitfish on my fish finder/graph, so why are all the surveys saying there are not many baitfish in the lake?**
   The surveys are a comprehensive assessment of the prey fish community using consistent techniques applied at representative locations throughout the entire lake. Anglers typically target a relatively small area of Lake Michigan, whereas surveys conducted by natural resource agencies target representative locations throughout the lake to get a statistically valid depiction of the entire prey fish community. While we certainly have alewives in Lake Michigan, we also have enough warning signs that their population may be in decline or unstable; thus leading to concerns about the long-term sustainability of the Chinook salmon fishery.

10. **Were surveys conducted to detect alewives in the Upper Peninsula waters of Lake Michigan?**
    Prey fish populations (including alewives) are assessed using both trawl and acoustic sampling methods through collaborative efforts of the US Geological Survey Great Lakes Science Center, the US Fish and Wildlife Service, and the Michigan Department of Natural Resources. Bottom trawl surveys in Lake Michigan have been conducted during the fall annually since 1973. Seven transect sites have been consistently surveyed annually, including a Manistique area site.

11. **Why can't we stock alewives to increase their abundance?**
    Stocking alewives is logistically and economically unfeasible due to the number of fish needed to stock to have any impact in a water body the size of Lake Michigan.

12. **What is our current stocking strategy meant to accomplish?**
    The current stocking strategy is meant to maintain a sustainable predator prey balance by maintaining both Chinook salmon and alewives.

13. **How many wild Chinook salmon are in Lake Michigan?**
    Recent studies show that more than 50% of the Chinook salmon in Lake Michigan are of wild origin and in some years it may run as high as 66%. The majority of wild Chinook salmon in Lake Michigan are produced in Michigan streams.

14. **How are Chinook salmon numbers estimated?**
    Chinook salmon numbers are estimated by combining angler catch rates, weir returns, and biological data in a lakewide stock assessment model. The model includes inputs for both the number of salmon stocked and the number of wild salmon produced (estimated independently via marking studies such as OTC and coded wire tag mass-marking). Based on the number of salmon inputted into the model, estimates of growth, maturation, and survival are produced to track the number of salmon over time.

15. **How does Michigan DNR make Chinook salmon stocking decisions? Is it possible to stock more Chinook salmon in different locations?**
    Locations and fish stocking numbers for 2013 were determined after much discussion and consideration among Michigan DNR Fisheries Division staff and stakeholders. A number of different criteria were used in the discussion, including catch, angler use, net pen vs. direct stocking, and economic interests. Stocking changes are possible, as long as the guidelines are followed for maintaining the predator prey balance. Stakeholders should continue to work with their local Fisheries Division staff to discuss opportunities for changes. For example: if natural reproduction from northern lower Michigan continues to support the fishery and provides adequate adult returns to the Little Manistee Weir (primary egg take facility), there may be an opportunity to move more stocking to the Upper Peninsula and southern Michigan ports that have less natural reproduction.

In addition, mass-marking data will provide a substantial amount of information on the return rates for our stocking sites. Based on this information and angler feedback, we will likely refine our stocking allocations over time.

16. Because we caught fewer Chinook salmon in 2013, is there a chance we will be returning to a three salmon per day catch limit in 2014?

The current protocol to determine the salmon bag limit was developed collaboratively between stakeholders and DNR Fisheries Division. The protocol identifies benchmarks for the percent of charter anglers catching three or more Chinook salmon per day (13.1%) and the catch rate (fish per hour) of Chinook salmon (0.165). If the estimated values for the success of charter anglers or catch rates drop below both benchmarks in any given year, then the bag limit for Chinook and coho salmon will be decreased to three. If the estimated values for the success of charter anglers and the catch rate are both above their respective benchmarks, then the daily bag limit for Chinook and coho salmon will be set at five fish per angler per day. If one of the estimators is above its benchmark while the other is below its benchmark, then there is no modification to the daily bag limit for Chinook and coho salmon from what it was in the previous year.

The 2013 estimate of charter anglers catching more than three Chinook salmon was 2.9%. The 2013 catch rate estimate was 0.226 fish per hour. Therefore, since only one metric fell below the threshold, our protocol indicates that we will not adjust the bag limit (stay at five) for 2014.

If you have any questions about the FAQs or salmon stocking program please contact:

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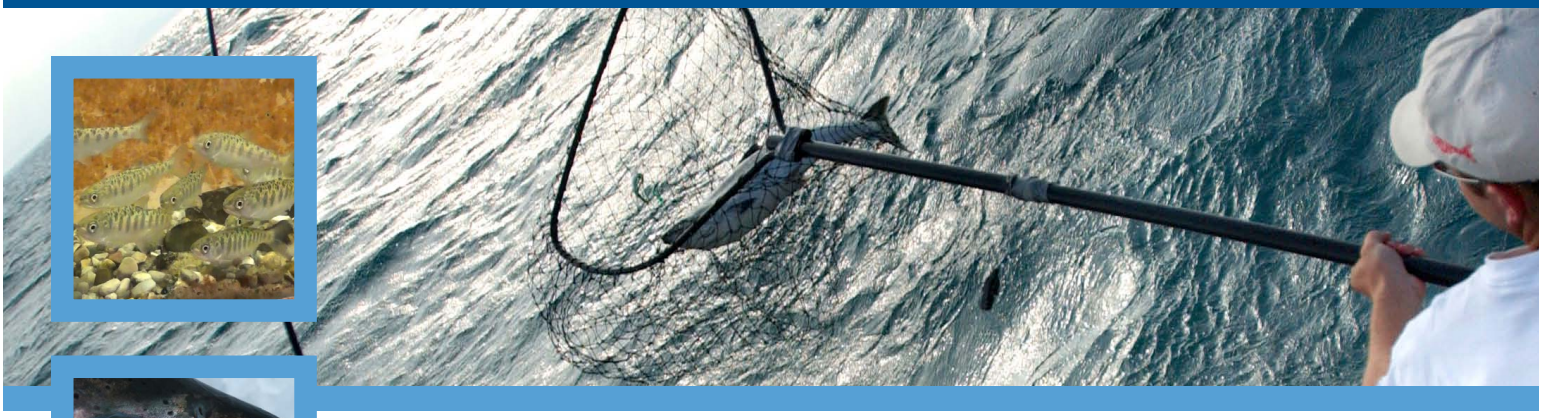

2012 LAKE MICHIGAN SALMON STOCKING SURVEY RESULTS

Fisheries managers around Lake Michigan now face a difficult dilemma. The lake's world-class sport fishing for five salmon and trout species is in jeopardy.

Check out www.miseagrant.umich.edu/fisheries/stocking for the background science and process behind development of the four options, full presentations and audience comments from the April 14 meeting.

In short, the production of baitfish in Lake Michigan may not be high enough or consistent enough to maintain the number of predatory gamefish.

Managers and scientists worked with stakeholders from Illinois, Indiana, Michigan, and Wisconsin to develop and evaluate options for decreasing the number of salmon and/or trout stocked into Lake Michigan on an annual basis. This fact sheet provides a summary of the survey responses. The primary purpose of the survey, and the preceding outreach to stakeholders, was to evaluate stocking options on a lakewide basis in recognition of the fact that Lake Michigan and its fish are shared resources.

SURVEY METHODS

Options were shared at a public meeting on April 14, 2012. The four proposed options were the result of a collaborative process that involved key stakeholder groups and computer simulations that evaluated potential outcomes.

An online survey was developed to gauge reactions to proposed stocking reductions. Survey respondents were given a summary of the outcomes, which allowed for objective comparison of the risks associated with each. Survey submissions were accepted through May 18, and the survey was referenced in several newspaper articles, online message boards, e-mail lists, and club presentations to encourage stakeholder participation. Excluding incomplete and duplicate entries, 580 surveys were returned (IL=128, IN=34, MI=271, WI=118).

REACTION TO PROPOSED OPTIONS

Survey respondents were asked to rate their level of comfort with each of the proposed options on a scale of one to five with five being the highest. Options were also ranked from best to worst.

OPTION 1: 50% reduction in Chinook salmon stocking for 2013.

- Average Rating: FAIR (1.97)
- Ranking: 69% WORST, 11% BEST

OPTION 2: 50% reduction in Chinook salmon stocking for 2013; automatically adjust stocking in future based on feedback policy.

- Average Rating: between FAIR and NEUTRAL (2.61)
- Ranking: 2% WORST, 20% BEST

OPTION 3: 30% reduction in Chinook salmon stocking and 10% reduction in coho salmon, steelhead, and brown trout stocking for 2013; automatically adjust stocking in future based on feedback policy.

- Average Rating: NEUTRAL (2.96)
- Ranking: 8% WORST, 15% BEST

OPTION 4: 30% reduction in Chinook salmon stocking and 10% reduction in coho salmon, steelhead, brown trout, and lake trout stocking for 2013; automatically adjust stocking in future based on feedback policy.

- Average Rating: between NEUTRAL and GOOD (3.28)
- Ranking: 20% WORST, 54% BEST

TABLE 1. Percent of all respondents (n=580) who commented on species-specific stocking recommendations. Note that shaded recommendations have some overlap with Options 1-4, and that these percentages only reflect write-in comments from respondents indicating a preferred option that differed from Options 1-4.

	100% Decrease	51-99% Decrease	31-50% Decrease	11-30% Decrease	1-10% Decrease	Unspecified Decrease	None	Increase
Chinook Salmon	6%	2%	4%	6%	1%	4%	3%	0%
Lake Trout	3%	2%	2%	3%	3%	1%	7%	1%
Steelhead	2%	0%	1%	2%	4%	0%	8%	5%
Brown Trout	2%	1%	1%	2%	4%	1%	6%	3%
Coho Salmon	3%	1%	1%	3%	4%	2%	6%	2%

TABLE 2. Number of all respondents who commented on state- or port-specific stocking reductions. Comment themes mentioned by less than 15 respondents are not shown.

States reduce evenly	74
States with more natural reproduction reduce more	101
Ports reduce evenly	57
Ports with more natural reproduction reduce more	55
Greater Reductions in Michigan	71
Greater Reductions in northern part of lake	30
Reductions based on angler effort or club support	30

RATING AND RANKING

Option 1 was the lowest rated by respondents in all four states. Reactions to other options were mixed, with ratings averaging close to neutral (3.00) for each. Option 4 had a slightly higher average rating, but reactions to Option 4 were more polarized due to the inclusion of lake trout stocking reductions.

ALTERNATE OPTIONS

In developing this survey, it was recognized that some stakeholders would prefer either greater or lesser stocking reductions than those proposed. Although 55% of respondents indicated that they did not wish to propose another option, 15% proposed greater reductions in stocking and 18% proposed lesser reductions.

With five salmon and trout species being considered, the recommendations for alternate options varied greatly. Many respondents who called for greater reductions in one species also called for no reductions, or even increases, in other species.

Only one survey respondent out of 580 proposed an increase in Chinook stocking, while 97% were in favor of some decrease. Opinions were more divided for other species (Table 1). Some anglers mentioned species other than the five principal salmonines, with 4% suggesting an increase in walleye stocking and 2% suggesting the stocking of forage fish. Space was also provided in the survey for additional comments regarding state- and port-specific concerns.

WHERE SHOULD STOCKING CUTS OCCUR?

Two themes emerged from comments. Substantial support was voiced both for even reduction of stocking around the lake and for greater reductions in areas where natural reproduction of Chinook salmon occurs (Table 2). Michigan and the northern part of the lake were frequently mentioned as areas for greater reductions due to natural reproduction, although broodstock and economic considerations, as well as concern for Upper Peninsula ports, were mentioned by fewer respondents.

WHERE THE WILD FISH ARE

Chinook salmon are well known for their ability to home in on their natal stream and return to their place of birth (or stocking site) when they mature. Anglers sometimes assume this means that catches from states with high natural reproduction will be dominated by naturally produced fish, while catches in other states will be dominated by stocked fish.

Fisheries scientists have been studying angler catches to test this theory by looking for chemical (OTC) marks in salmon vertebrae. Their conclusion is that by age two, the stocked and naturally spawned fish are evenly distributed throughout the lake. This means that wild fish from Michigan tributaries (and also Lake Huron streams) contribute about equally to big lake fisheries in all four states bordering Lake Michigan.

This is encouraging news for big lake anglers since the percentage of naturally spawned Chinook salmon has increased from 19% to 56% in Lake Michigan over the past three decades. However, terminal pierhead, harbor, and river fisheries in areas that do not support natural reproduction may still be dependent upon stocked fish to ensure a late summer and early fall return of mature Chinooks.

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The Predator-Prey Ratio for Lake Michigan

By Randall M. Claramunt

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Michigan Department of Natural Resources

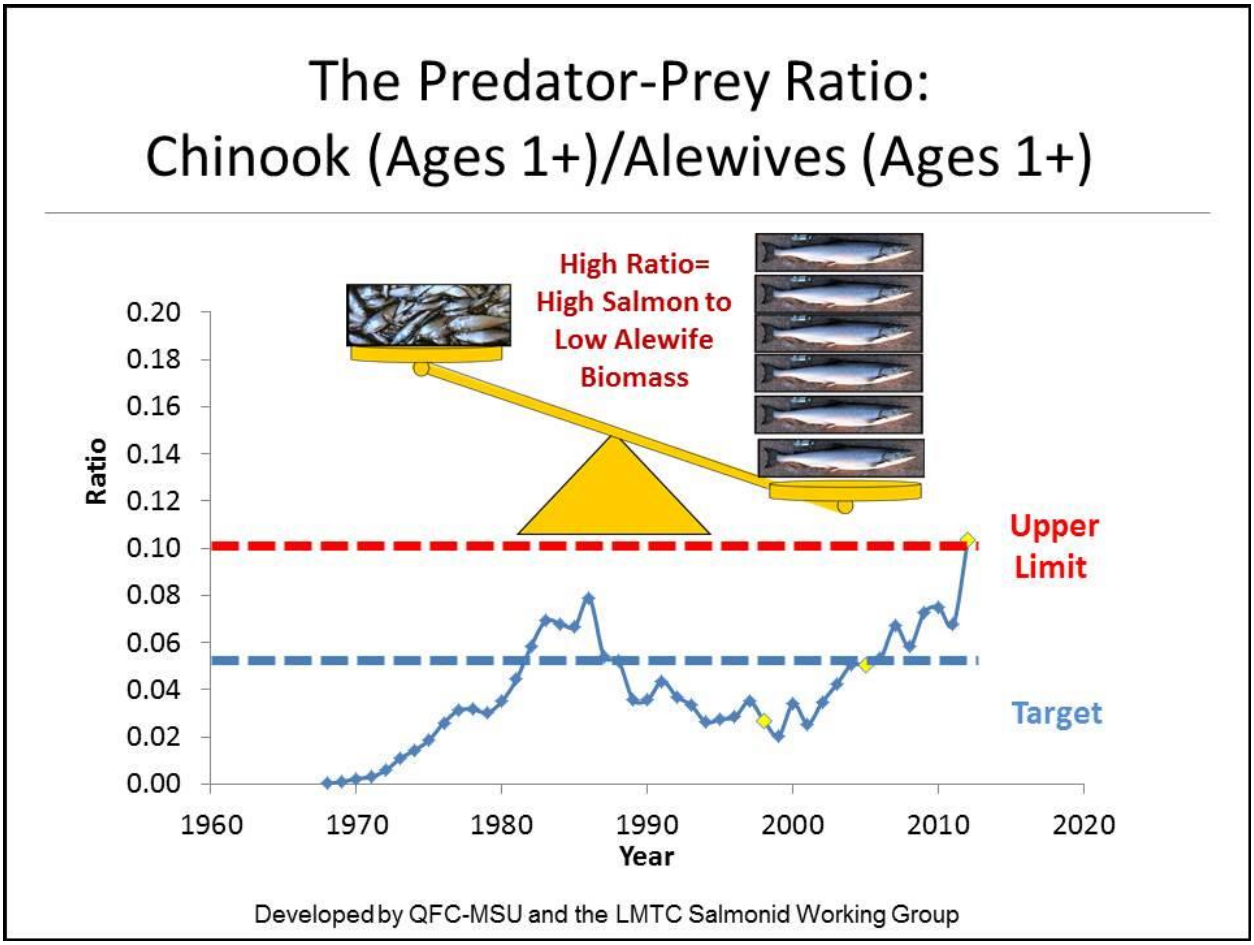
Lake Michigan is an expansive, complex, and constantly changing ecosystem – making management of the open water salmon fisheries challenging. Relying on one data set, such as fishery catch rates or returns to a particular weir, to guide management decisions may increase the risk of not selecting the best approach for setting stocking policies or harvest regulations. To address this challenge, the Lake Michigan Salmonid Working Group (SWG) developed a method to evaluate a list of biological indicators for gauging the population size and condition of Chinook salmon and alewives, their primary prey. The approach developed by the SWG, termed the Red Flag Analysis (RFA), was used from 2004 to 2010 to identify threats to the fishery on an annual basis and helped to guide past fisheries management decisions.

However, the RFA had limitations that became more evident over time, leading the SWG to request an outside, technical review of the method in 2011. The Quantitative Fisheries Center (QFC) at Michigan State University completed a critical review of the existing RFA in 2012 and subsequently worked with the SWG to develop an alternative method focused on a predator-prey balance or ratio (hereafter referred to as the proposed predator-prey ratio). The management agencies representing Lake Michigan have generally accepted and endorsed the predator-prey ratio analysis as the primary method to evaluate salmon populations, and their prey, in Lake Michigan. The intent of this article is to describe the details of the predator-prey ratio.

The predator-prey ratio analysis uses a primary but comprehensive indicator (which functions like a 'red flag') along with six supplementary or auxiliary indicators. The primary indicator is a ratio of total lake-wide biomass of Chinook salmon (≥ age 1) to total lake-wide biomass of alewives (≥ age 1). Statistical Catch at Age (SCA) models developed by the QFC are used to estimate total lake-wide abundance of Chinook salmon and alewives. Each abundance estimate is then multiplied by average Chinook salmon or alewife weights (per age group) to generate lake-wide, spring-time biomass estimates. When plotted as a ratio of total Chinook salmon / alewife biomass per year, managers can use this indicator to evaluate changes in predator-prey balance through time and also to assess present conditions. Additionally, a projection model is used to predict future ratios of Chinook salmon to alewife biomass based on averages of predator-prey ratios from previous years and planned future stocking numbers.

Recommended target and upper limit reference points for the predator-prey ratio have been established to provide guidance for management decisions. A target reference point, or targeted predator-prey ratio, is an ideal ratio which management efforts seek to achieve (i.e., a

management objective) while an upper limit reference point is a problematic ratio that managers seek to avoid. A ratio that meets or exceeds the upper limit suggests an unbalanced ecosystem with too many predators and relatively low forage biomass. For example, a recommended upper limit reference point of 0.1 indicates a condition where there are 10 pounds of alewives available in the system for every one pound of salmon. Based on literature reviews of other ecosystems and on plots of the ratio in Lake Michigan in the past, when the ratio exceeds 0.1 predator biomass has reached its biological limit and a decline in salmon abundance is imminent. If the calculated predator/prey ratio approaches the upper limit, then management actions should be taken (e.g., reduce stocking or increase harvest policies) to reestablish a balanced ecosystem. Following the same logic, a target reference point of 0.05 has been recommended; at this level, there are 20 pounds of alewives available for every one pound of salmon in Lake Michigan. When the predator-prey ratio is at or near 0.05 then current salmon and alewife levels are most consistent with lakewide goals and objectives. When the ratio is very low (well below 0.05), then prey levels are high and polices aimed at building up the salmon stock (e.g., higher stocking rates, lower harvest regulations) are recommended (see Figure below).



In addition to the predator-prey ratio, six auxiliary or supplementary indicators are also summarized in the new approach. Auxiliary indicators include: Chinook salmon condition estimated from creel biodata, charter catch-per-effort for Chinook salmon, weights of age 3+ female Chinook salmon from fall weir and harbor collections, multi-species harvest composition, a fish community objective index, and alewife age structure. Evaluations for auxiliary indicators will not involve triggers or 'red flags'; percentiles, targets, and limits will not be used. Auxiliary indicators will be presented as individual datasets through time, and will simply allow managers to visually evaluate trends as a way to ground-truth the predator-prey ratio and provide additional information to guide management decisions. Previous lake-wide changes to stocking in 1999, 2006, and 2013 were made with a multitude of information, from various sources, including public feedback. The predator-prey ratio is based on the same sources of information, but is the most efficient and substantive method to link salmon and prey levels to guide fisheries management in the future.

Caveat to the Predator-Prey Ratio: Diversity in the Fishery

The predator-prey ratio is limited to evaluating a balance between Chinook salmon and alewives. It is important to note that management goals include a diversity of other predator-prey interactions. This diversity will help to provide a more balanced fish community and overall fishery. For example, brown trout, coho salmon, rainbow trout (aka steelhead), and lake trout are important components of the fishery and are known to consume a diversity of prey including alewives. As catch rates of Chinook salmon have declined recently, the harvest of brown trout and steelhead doubled in Lake Michigan in 2014. The predator-prey ratio is the most advanced analytical approach to evaluating and making predictions for the open-water Chinook salmon fishery, but inferences to other species or other components of the fishery should be made with caution.

This article was produced in collaboration with Rick Clark (Michigan State University-Quantitative Fisheries Center), Nicholas Legler (Wisconsin Department of Natural Resources), and Tracy Kolb (Michigan Department of Natural Resources).

DATE: November 20, 2013

TO: Cathy Stepp - Secretary

FROM: Michael Staggs – FM/4

SUBJECT: Lake Michigan Chinook salmon stocking recommendation

Summary: We recommend stocking 808,255 Chinook salmon in 2014 (similar to 2013 stocking levels) and using a revised Chinook salmon allocation strategy described below to distribute those fish among counties along the Lake Michigan coast. Over the past 2 years Fisheries Management has been working with stakeholders to balance Chinook salmon and other predator stockings with a declining prey base and increasing levels of salmon natural reproduction, and to determine how stocked fish should be distributed along the lake shore. Salmon are highly migratory so stocking location has little impact on spring and summer fisheries, but mature salmon return to their original stocking location to spawn and this can affect local fall fisheries. We heard loud and clear the importance of the fall fisheries to the local economies and local fishing opportunities. The revised strategy allocates 75% of the Chinook salmon equally among most counties and 25% differentially among most counties based on 3 measures of September and October fishing: number of charter boat trips, total hours of directed angler effort for Chinook salmon, and Chinook salmon harvest rate. Generally the strategy applies to each county, but stocking locations in Door, Marinette and Oconto counties are handled differently to fairly account for a large stocking to maintain the spawning run at the Strawberry Creek weir in southern Door Co, and for the presence of other fisheries in Green Bay. Based on stakeholder input, the initial proposal was modified to reduce stocking at Strawberry Creek from 175,000 to 120,000 with the difference being distributed among other stocking locations. Also northern Door County will receive a separate allocation of 30,000 fish rather than be combined with Marinette and Oconto counties. We will run the allocation formula every year and adjust stocking numbers accordingly. When our current study of coded wire tag returns is completed in 2015 or if we get substantially new information we will revisit the strategy with our stakeholders.

County	Chinook to be stocked
Kenosha	76,919
Racine	75,338
Milwaukee	83,046
Ozaukee	89,049
Sheboygan	86,164
Manitowoc	83,515
Kewaunee	95,142
Southern Door-Strawberry Creek	120,000
Northern Door	30,000
Oconto/Marinette	69,082
Wisconsin Total	808,255

Approved:

Kenneth A Johnson

11-26-2013

Ken Johnson, Water Division Administrator — Date

Cathy Stepp, Secretary

12-05-13
Date

Rationale

Stock 808,255 Chinook salmon in 2014

The States managing the Lake Michigan fishery have long cooperated to implement salmon and trout stocking programs that optimize fishing by balancing the number of predators in the lake with the available forage fish. Stocking too few fish allows nuisance species like alewives to become overly abundant, and reduces fishing opportunities and associated economic benefits. Stocking too many fish will crash the forage population and collapse the fishery with dire consequences for communities and businesses that depend on the fishery as happened on Lake Huron in the early 2000's. Over the past two decades, we have seen a decline in overall forage abundance and an increase in trout and salmon natural reproduction which have required periodic adjustments to stocking numbers to maintain a good trout and salmon fishery. The most recent adjustment was in 2013.

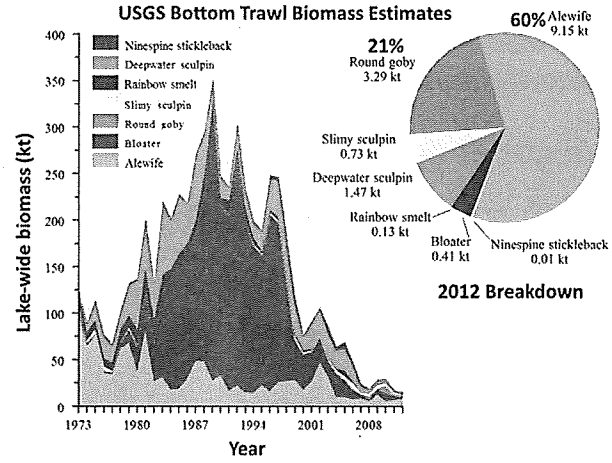
Beginning in the summer of 2011 and continuing through a Lake Michigan Fisheries Forum (LMFF) meeting in December 2012, Fisheries Management along with sister agencies on Lake Michigan, engaged interested stakeholders on the correct number of Chinook salmon to stock into Lake Michigan. During nine formal meetings and many other outreach avenues, stakeholders had the opportunity to listen to information, provide feedback and help managers decide on the appropriate number to stock. After this intensive process, state agencies agreed that stocking 50% fewer Chinook salmon in 2013, 2014 and 2015 was the next adjustment necessary to balance predator and prey populations. Because much of the increasing salmon natural reproduction is occurring in their waters, Michigan reduced their stocking by the largest amount. Wisconsin reduced Chinook salmon stocking by 30% and maintained lower stocking levels of Coho salmon and rainbow trout that had resulted from temporary hatchery problems. That amount for 2014 would be 808,255 Chinook salmon.

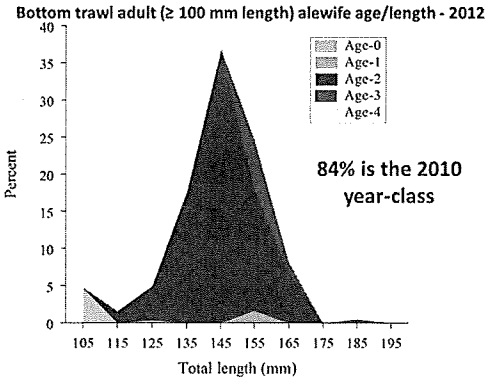
During the public meetings, stakeholders reviewed several key pieces of information that they agreed indicated signs of an ecosystem not in balance. These key pieces of information included a) historically low alewife biomass estimates provided by the US Geological Survey, b) severe alewife age truncation in the population with basically all the fish comprised of individuals less than 4 years-old, c) low weights of age-3 female Chinook salmon measured at Wisconsin's Strawberry Creek Weir and d) modeling efforts that demonstrated a much higher risk of alewife collapse with higher sustained stocking levels of Chinook.

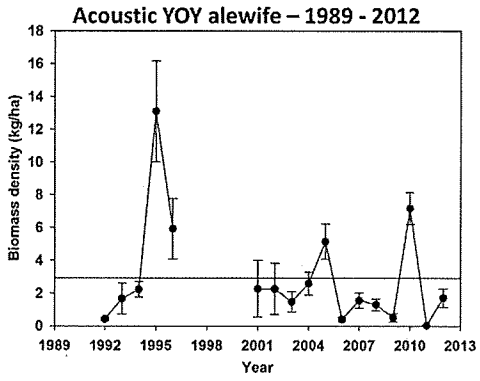
Anglers reported that Chinook fishing was relatively poor throughout parts of the 2013 fishing season, which led some stakeholders to question the stocking reduction. Many anglers observed fewer but much larger fish caught, and large numbers of baitfish on their depth sounders and concluded that the Department had overestimated the number of salmon and underestimated the amount of forage present. However as detailed below, the preliminary data on angler harvest, spawning weir returns and USGS forage trawling from 2013 continues to show that predator abundance is still too high relative to forage abundance and that increasing stocking in 2014 would be problematic.

Alewife numbers and biomass, as measured by the US Geological Survey remain at historically low levels. Information through 2012 (see figures below) shows that lakewide alewife biomass continues to be less than 10% of that observed through the late 1990s. Additionally, alewives in the population are

mostly young age classes. It appears that individuals older than age 4 are reduced or absent because of heavy predation. Preliminary information from 2013 further confirmed that the age composition of the population is very young and that the 2013 year-class was probably below average. The alewives that anglers have been seeing on their sonars and finding in the stomachs of caught salmon are likely from a great hatch in 2010 and an average hatch in 2012. These year-classes alone are not enough to allow additional salmon to be stocked in Lake Michigan.



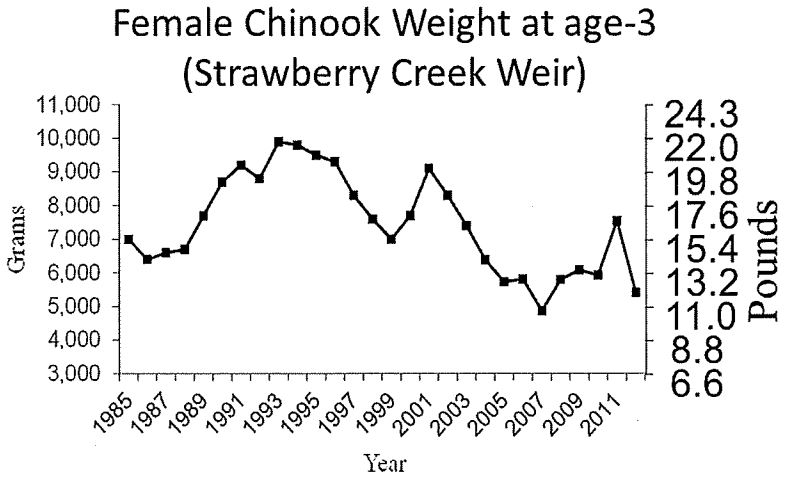




While Chinook salmon harvests in 2013 will be lower than the historically high harvest recorded in 2012, there was still a large population of Chinook salmon in the lake. Anglers reported that fishing improved dramatically in the fall when salmon returned to the place they were originally stocked. Returns of salmon to spawning weirs in Wisconsin and Michigan also ended up being higher than or comparable to past years. It is likely that unusual weather conditions that persisted into the summer contributed to poorer fishing by causing fish movements away from traditional fishing waters.

To the extent that Chinook populations were lower in 2013, it is important to emphasize that stocking reductions in 2013 had no impact on fishing in 2013 and will likely not have any impact until 2015 when these stocked fish will be 2 years-old. Of more critical concern is that the 2006-2012 stocking rates which resulted in the record setting Chinook harvest in 2012 also caused the lower harvest in 2013. Any reductions in Chinook populations in 2013 could be partially attributable to poor survival of stocked or naturally reproduced fish resulting from extremely low alewife production in 2011. This should be of serious concern to those advocating a return to earlier stocking levels.

The weight of Chinook salmon harvested by anglers and at Wisconsin weirs in 2013 appears to be heavier than in 2012. This indicates that in 2013 predator numbers were lower relative to alewife numbers in the lake. The higher average weight is a good sign but the 2012 average weight of age-3 female Chinook salmon at Strawberry Creek was the second lowest on record (see figure below). Such wild fluctuations are not typical in a stable or balanced system so we should be even more cautious about stocking too many predators. Based on the extensive modeling work that was done, agencies are recommending that the index weight of age 3 female Chinook at Strawberry Creek should reach a three year average of 9 kg before increases in stocking should be considered. In 2012, those Chinook averaged 5.4 kg. Our preliminary analyses of 2013 returns shows the average weight will remain well below the 9 kg threshold – again showing that it is premature to consider stocking increases.



Wisconsin DNR, along with our sister agencies, will continue to monitor and measure the critical information needed to evaluate and maintain a high quality Chinook salmon fishery into the future. During this process we have not only used historical information to make our initial decision but continue to use the most recent information to further our understanding of the important link between prey fish biomass and stocking levels of salmon and trout.

Selection of parameters for allocation strategy

In the 1980s, the Department created an allocation model to distribute salmon and trout among the Lake Michigan counties to resolve persistent competing and conflicting stocking demands from users in different areas of the lake. This allocation created a systematic approach to the distribution and was based on counties rather than ports. It relied on fisheries biologists working with stakeholders to locally allocate fish in counties where multiple ports occurred. With the lakewide stocking reduction, the question of distribution of the remaining fish was raised again.

A review of the existing formula was conducted by the Department and stakeholders at the December, 2012 LMFF meeting. We found that the older formula included parameters that have changed significantly and agreed to develop a new stocking strategy that would better reflect our knowledge of the current Lake Michigan fishery. At the April 2013 meeting LMFF members generally agreed upon several principles: 1) the summer open water fishery was the most important fishery but not heavily influenced by the number of fish locally stocked; 2) supporting fall tributary fisheries in all areas of Wisconsin is more desirable than just focusing on a few areas; and 3) a revised strategy should including economic factors, but still be easy to analyze and simple to understand. Based on those principles, DNR

staff and LMFF members created a draft strategy which equally allocated 75% of the fish among counties, and differentially allocated the remaining 25 among counties based on 3 parameters: 1) the number of charter boats per county averaged over 5 years, 2) angler effort directed at Chinook salmon in the fall averaged over 10 years and 3) the Chinook salmon harvest rate averaged over 10 years.

Two changes to this strategy were made based on input received during a formal public comment period and a final LMFF meeting held on October 12. The final strategy would use the number of charter trips in September and October averaged over 10 years rather than the number charter trips for the entire year averaged over a five year period. It was felt this parameter should be more reflective of fall fishing activity. In addition, we have created a placeholder for information from the coded wire tag (CWT) study that began in 2013 and will give us better insight as to migration and homing patterns of stocked fish. We anticipate that this parameter will be ready for inclusion in the strategy in 2017 and will re-engage the LMFF when we have that information. This parameter will address survival and contribution of stocking locations to the overall fishery which will address the Forum's principle that the summer open water fishery is the most important component of the fishery.

County based stocking strategy

The Department received feedback suggesting the strategy should allocate fish among individual stocking locations - particularly individual ports - rather than counties. In building the new Chinook salmon allocation strategy, we recommend continued used of counties as an allocation unit. Generally, counties remain a recognizable geographic and economic entity, and efficiently represent a collection of harbors, tributary streams, boat ramps, and shore fishing sites. Based on comments received, it appears that the vast majority of stakeholders are satisfied with that approach.

While it would be possible to collect and analyze information separately for each possible stocking site, it is not clear that the increased complexity and cost to collect accurate information at that level would yield any appreciable improvements to the overall fishery.

While comparable information on harvest, effort and use are available for all counties, we do not have this information available for all stocking locations or stocking ports. We could redesign the creel survey to capture port specific information. In some cases, we could do this with increased effort and cost, but in other cases even with increased effort and cost it would be highly unlikely we could get large enough sample sizes (number of interviews and counts) to adequately estimate effort and harvest rate by port or stocking location.

One important concern about using a county-based approach is that it somehow disadvantages counties with multiple ports. However, there is not a mathematical difference in having one or multiple ports in a particular county. The number of charter trips is summed for all ports in a county and the total fall Chinook salmon directed fishing effort is summed for all areas and ports in a county to accurately reflect all of the effort in the county.

The current strategy allocates a portion of the stocking numbers by county except in Door, Oconto and Marinette counties. The Department must maintain a high level of stocking at its Strawberry Creek spawning weir to ensure that adequate numbers of adult salmon will return 3-4 years later. This is a critical stocking to maintain adequate levels of hatchery spawn collection but traditionally places a large percentage of the entire state stocking in southern Door County. Based on stakeholder feedback, we

propose to reduce this stocking from 175,000 to 120,000 with the difference being distributed among other stocking locations. We will rely on our other egg collection weirs (Besadny Anadromous Fisheries Facility and Root River Steelhead Facility) if unexpected shortfalls in spawning fish occur at Strawberry Creek.

We also heard from stakeholders about the importance of maintaining good trout and salmon fisheries in northern Door, Oconto and Marinette counties. In the initial proposed strategy, these three areas were combined into one stocking unit, however based on stakeholder feedback we are recommending treating northern Door county as a separate stocking unit. In contrast to most counties, northern Door county has numerous small harbors and tributary streams and fall fishing in these locations would not benefit from the Strawberry Creek stocking location. To address this structural inequity, we would directly reallocate 30,000 fish to stocking locations in northern Door Co. Oconto and Marinette were grouped together for this allocation because of historical stocking patterns, availability and quantity of cold water in the bay and presence of other game fish species in the lower portion of the Bay.

In all counties, local fisheries staff will work closely with stakeholders to optimize the number of fish stocked at specific locations.

75% base/25% differential county allocations

LMFF member and other stakeholders initially agreed that the revised strategy should allow for fall fishing opportunities in all counties of Lake Michigan and Green Bay so some level of stocking must occur in each county regardless of the strategy. However, stakeholders also wanted to differentially allocate fish based on economic and actual use patterns in the fall fishery in each county. Following extensive discussions with stakeholders, the revised strategy would allocate 75% of fish generally split equally among all counties, and 25% of fish generally differentially allocated among all counties based on fall fishing parameters.

This part of the strategy was presented at both the April and October meetings of the LMFF. We received a few comments that suggested the fall differential allocation be at least 50% of the stocking if not 75%. Under our recommended allocation strategy, stocking numbers by county vary from a low 69,082 to a high of 95,142 (a range of 26,060 fish). If more weight were given to the parameters the discrepancies among counties would be much greater, and would likely lead to increased controversy among all the constituents, and possible loss of fall fisheries in some locations due to low numbers of returning fish. While the recommended strategy is not completely satisfactory to all stakeholders, the strategy will address the principles laid out at the April Forum meeting. It will provide more fish in areas that have higher values for all the parameters and it will still leave enough fish to be stocked in each county to provide each with a fall fishery.

Additional comments

Throughout this entire process, we gathered public comments that helped guide and shape the strategy presented in this memo for approval. In the previous sections, we have discussed some of the overarching comments and how we propose to address them. Additional comments that we received are grouped together below by issue. This is not an exhaustive list of all comments, but focuses on those germane to this strategy.

Comment. Stocking of Chinook salmon stopped in Gills Rock in the 2000s. The DNR should stock fish in Gills Rock instead of Ellison Bay. Various reasons were given.

Answer. Stocking of Chinook salmon in Gills Rock was stopped in 1999 and switched to Ellison Bay for a variety of reasons including 1) no public boat ramp in Gills Rock (it was privatized), and 2) a DNR study that showed stocking Chinook salmon directly in the lake reduced their survivability compared to harbor or river stockings and Ellison Bay provides more protected areas than does Gills Rock. Studies show that salmon are highly migratory so this change would have had no effect on the local fisheries, however local fisheries management staff will work with northern Door County stakeholders to determine the most appropriate stocking locations for the Chinook salmon allocated to northern Door County.

Comment. Chinook salmon stocking reductions have hurt local businesses in Gills Rock, stock more Chinook salmon in Gills Rock. Others wanted more fish stocked in Door County or northern Door County.

Answer. Door County Chinook salmon will be directly allocated rather than following the strategy like the rest of the counties due to the Chinook salmon egg take facility, Strawberry Creek being located in Door County. Under this final strategy Door County will get 150,000 Chinook salmon. Northern Door County we receive 30,000 fish and southern Door County (Strawberry Creek) will receive 120,000 fish annually.

Comment. We request no change to the stocking allocation until the 5 year coded tag study is completed to know more clearly what really is happening with the Chinook fishery in the Lake.

Answer. The vast majority of stakeholders and DNR fisheries staff agreed that the old allocation model developed in the late 1980s and used until 2013 needed to be changed. Through the course of two LMFF meetings and various comment periods, we did not get significant feedback that we should delay this strategy until the coded wire tag study was completed. We were able to use current fisheries information like the number of charter boat trips, directed effort and directed harvest rate to fairly distribute Chinook salmon. One of the factors in the strategy is a code-wire tag (CWT) factor to be developed once more CWT data are obtained and analyzed. If substantial new information is gained from the CWT study, we will reengage the LMFF on this allocation strategy to determine if modification of the strategy would be necessary.

Comment. Stock more salmon and trout including Coho, browns and rainbows.

Answer. As described above, stocking more trout and salmon would be very risky because of the current low abundance of prey. In response to this situation, Lake Michigan agencies agreed on an overall Chinook salmon stocking reduction and strategy for 2013 and beyond. The overall stocking numbers of Chinook salmon and of other species like Coho, browns, rainbows and lake trout are agreed to by all the Lake Michigan agencies. As part of our Chinook salmon strategy, we have the option to stock fewer Coho salmon and rainbow trout and increase the number of Chinook salmon that we stock. For 2014, Wisconsin will stock 140,000 less lake trout from the Federal hatcheries in order to stock more Chinook salmon. Also, due to current hatchery limitations we cannot produce the full amount of Coho salmon, brown trout and rainbow trout that we desire so we are stocking a comparable number of additional Chinook salmon. If hatcheries are renovated and able to produce the full agreed upon numbers of these species we will at that time need to address this trade off of stocking the maximum number of Chinook salmon versus stocking the maximum number of the other species.

Comment. Other brood rivers such as the Kewaunee and Root should receive a base allocation like Strawberry Creek.

Answer. Under this strategy, we will have enough Chinook salmon stocked at both the Kewaunee and Root Rivers to provide enough backup for Strawberry Creek.

Comment. You should consider Coho salmon and other stocked species at the ports or counties in determining the numbers of Chinook salmon. This comment came from northern Door County stakeholders who wanted to eliminate Coho stocking and instead stock proportionally more Chinook salmon in this area.

Answer. To the extent possible, the Department approaches trout and salmon management in a holistic manner looking at the whole suite of possible fishing opportunities. However, including multispecies into this Chinook salmon stocking strategy would make the strategy much more complex and stakeholders wanted a simple, straightforward strategy. We remain open to working with stakeholders to review stocking strategies for other species.

Comment. The Chinook salmon stocking number is too large of a reduction for Green Bay. Green Bay already had Coho salmon stocking eliminated.

Answer. In 2013, 81,160 Chinook salmon were stocked into Marinette and Oconto counties. In this final strategy, 69,082 Chinook salmon will be stocked into these counties for a 14.9% reduction. This change is largely due to reliance upon the number of charter trips in the fall and Chinook salmon fishing statistics to determine stocking numbers. As describe above, Coho stocking numbers are not being considered in this Chinook salmon stocking strategy but we remain open to future discussions with stakeholders on Coho salmon stocking. Green Bay also receives significant stockings of brown trout and has outstanding bass, walleye, musky and panfishing not found in other areas of Lake Michigan.

Comment. DNR should take into account the higher summer tourist population in Door County.

Answer. In this strategy, the number of charter trips and number of angler hours are both factors that capture the fishing component of fall tourism. Our research shows that salmon are highly migratory and stocking locations do not affect the quality of the fishery in the summer.

Comment. Do something about the fish eating birds.

Answer. The impacts of cormorants on fish populations have been well documented. We have been working with the Federal Wildlife Services program to manage cormorant populations in Green Bay and the managed cormorant populations are near or below target levels. Impacts of other fish eating birds are not as well documented and this is a research priority of the Lake Michigan Fisheries Team.

Comment. Need to do a better job of planting and let sports clubs help more.

Answer. The Department's stocking plans are based on decades of experience and have created outstanding fishing in Lake Michigan. However, they are complex and logistically challenging, requiring that we prepare and plan well in advance of the stocking event. Stocking events must be scheduled to not only maximize survival of the stocked fish but work within each hatchery systems schedule to insure

that we can stock the maximum number of fish not only in the Great Lakes but inland as well. There are numerous logistical, environmental, and biological factors that are considered when stocking fish. We continue to work with several sports clubs from various areas on stocking fish and appreciate the volunteer help that we receive. We remain open to exploring additional opportunities.

Comment. Why does Door County rank so high yet does not receive the reflective proportion of Chinook salmon?

Answer. In the initial release of the proposed strategy it appeared as if the fish stocked in northern Door County were the only fish stocked in Door County. This is not the case. In this final strategy, Door County receives 150,000 Chinook salmon which is the highest of any county. This is due to the Chinook salmon egg take facility, Strawberry Creek being located in Door County.