Draft

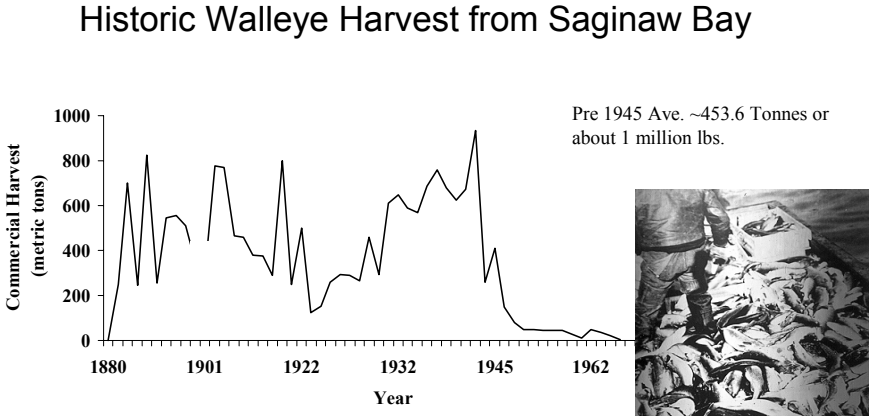
Michigan DNR

Saginaw Bay Walleye Recovery Plan

NASA photo

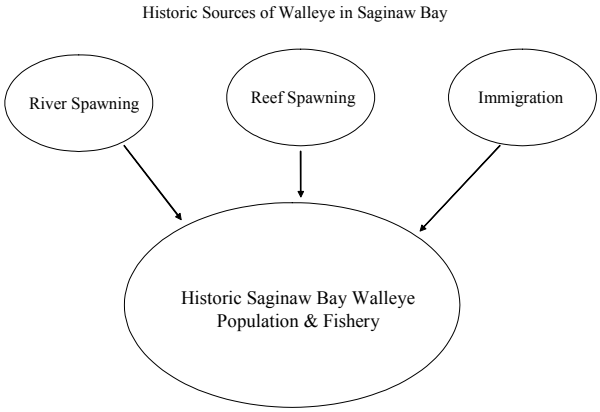
Saginaw Bay, today, enjoys a reputation of good walleye fishing. On average, nearly 100,000 walleyes are harvested each year in the sport fishery from the open water, ice fishery, and in the Saginaw River system. Its remarkable, however, that today's harvest levels amount to only a fraction of what was historically harvested from Saginaw Bay. Scientists believe that the walleye population there today is much smaller than what can be supported by the habitat and prey (food) resources. This plan is the blue print for how the Michigan Department of Natural Resources will work to recover the Saginaw Bay walleye population back to the full potential of the habitat and prey base.

How big was the walleye population historically?



Saginaw Bay's walleye fishery was second only to that of Lake Erie in all the Great Lakes before it collapsed in the mid 1940s. Back then there was little sport fishing but there was a large commercial fishery. That fishery took a long-term average of 1 million pounds of walleye each year (average from Late 1800s to mid 1940s). The harvest in numbers averaged about 600,000 walleyes each year. The commercial fishery, however, wasn't the reason the fishery collapsed. It collapsed because walleye quit reproducing in the bay and in the rivers that led to the bay. Today's sport fishery averages about 300,000 pounds and about 100,000 walleyes each year.

What happened to the original walleye population, why isn't it as big today?



Walleyes historically spawned in both rivers and on off-shore rock reefs. Walleyes are genetically predisposed to be either a river spawner or reef spawner and Saginaw Bay had both. There were several reasons why walleye quit reproducing in both places. The river spawning habitat first became fouled from the logging industry. Originally, the Saginaw Bay watershed was heavily forested and early loggers used the rivers to transport logs and dispose of wood pulp waste. Later, as the bay's watershed gave way to agriculture, the rivers were further degraded by erosion and sedimentation. The sedimentation also smothered off-shore reefs. In the early 1900s numerous dams were built on the rivers denying migrating walleyes access to their spawning grounds. Lastly, as the Saginaw River valley became industrialized in the mid 1900s, water pollution made much of the rivers and the bay uninhabitable for walleyes. As if that wasn't enough, non-native alewives, who invaded the Great Lakes from the Atlantic Ocean, became very abundant in Saginaw Bay in the early 1950s. Alewives are known today to be active predators on newly hatched walleye fry. Without walleye reproducing every year, the commercial fishery quickly depleted the remaining adult population and then collapsed. The commercial fishery for walleye was formally closed (and remains closed today) in the early 1970s.

Photo courtesy of State Archives

Prior to the collapse, walleyes were the "key-stone" predator in Saginaw Bay. Their predation on prey fish kept the entire aquatic ecosystem in balance. Once they disappeared, there was not enough other predators to take their place. The bay's ecosystem became over populated by prey fishes. Not only did this mean there was little for fishermen to fish for, but it made problems for other desirable species to reproduce and grow properly.

The turn around.

Mi. DNR photo David Kenyon

The foundation for recovery and a turn around in the situation began with the passage of the Clean Water Act in 1972. As a result, water pollution was greatly reduced and the low quality of the water was no longer an obstacle to walleyes in the bay. The Michigan DNR began stocking walleye fingerlings in the bay in the early 1980s and a sport fishery soon emerged. Over time, walleye stocking numbers have grown to an average of about 750,000 per year and the sport fishery expanded as well. The sport fishery, however, leveled off at its current levels by the mid 1990s, and hasn't expanded any further. The sport fishery, although fundamentally different from a commercial fishery, didn't measure up to historic yield or harvest levels.

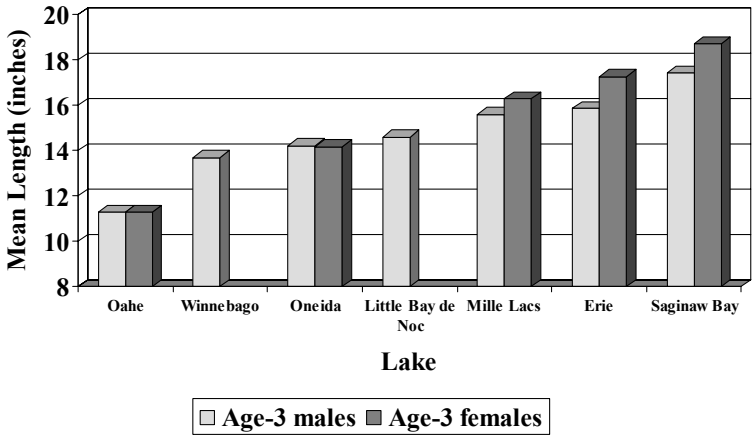
Early unknowns.

Even though Saginaw Bay had experienced a partial recovery of walleye, there were more questions than answers for DNR biologists. Where did the current population and fishery really rank compared to the potential of the bay? What were the sources of walleye recruitment to the bay's fishery? Was there any natural reproduction? How much of the fishery was due to stocking? All these questions prevented biologist from designing management strategies to further improve the walleye population and finish the job of recovery.

The Research Era.

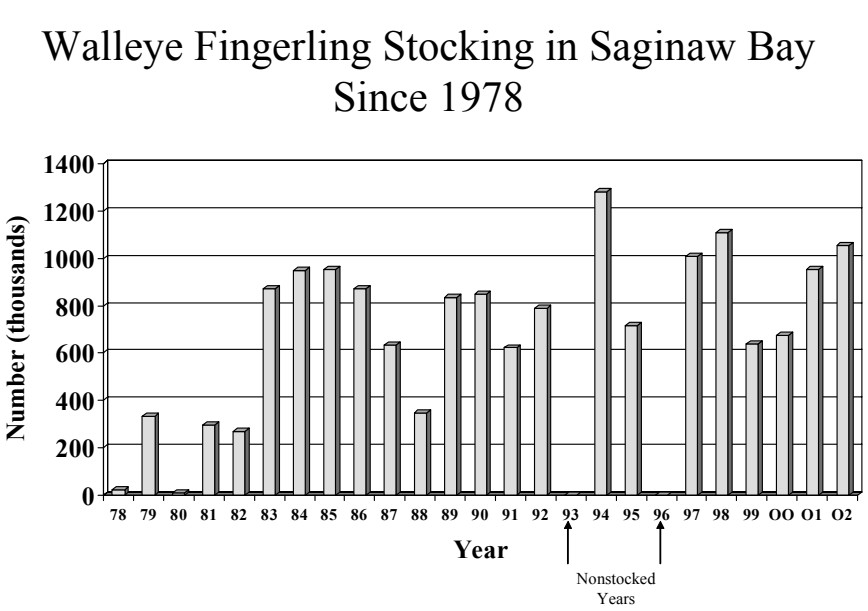
To answer these questions, the Michigan DNR embarked on a series of research projects beginning in the late 1980s. To answer the question of where the current population was compared to the biological potential of the bay's adult habitat and prey base, biologist studied the walleye's growth rate. Like a lot of animals, walleyes will grow faster when food and habitat is abundant. When walleyes are at low abundance levels, relative to the food and habitat available, they will grow fast. When there are many walleyes competing for food and space, then they will grow slower. Research sought to measure the growth rate of walleyes in the bay. A fast growth rate meant that there is room for more walleyes. The research found that

Walleye Mean Length-at-Age-3 Annulus for Seven Notable Midwest Walleye Populations



Saginaw Bay walleyes grew very fast for their species. Faster than almost any other walleye population in North America including Lake Erie. Their growth rate was also much faster than they grew in Saginaw Bay before their collapse. Other investigations also confirmed the prey resources in the bay were extremely abundant and vastly underutilized.

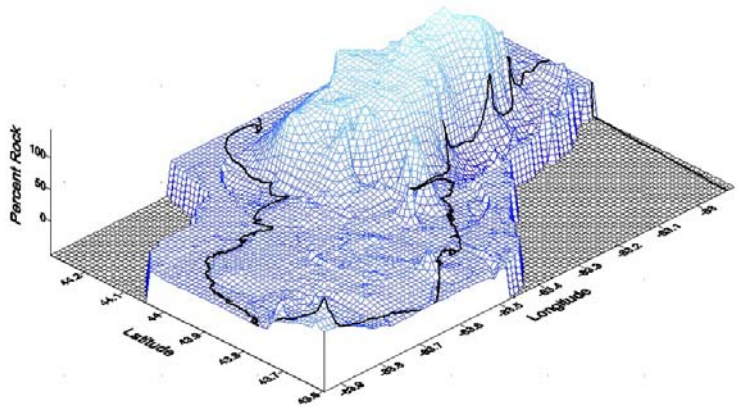
Research was conducted on natural reproduction levels and the contribution of stocking. Over the years, large migrations of spawning walleyes developed each spring in the Saginaw River system, particularly the Tittabawassee and Flint Rivers. The fish would migrate as far as they could before being stopped by dams. Research indicated that some of the eggs from these spawning runs were hatching. Genetic evidence also indicated that these runs were growing "more wild". These were very positive signs for the walleye recovery effort but it was already known that the overall population was not expanding any more after the mid 1990s. In order to learn how much of the yearly production of walleyes (year class) was attributed to natural reproduction (and conversely how much was from stocking), the DNR suspended stocking in two different years (1993 and 1996) to measure the effect. The resulting recruitment levels, in fact, showed some natural reproduction those nonstocked years, but it was only about 20% as much as in years with stocking.



Starting in 1997, all the hatchery walleyes released in the bay were marked with a chemical called OTC. The OTC produced a tiny fluorescent mark on their otoliths (small bones used for balance like ear bones). This allowed biologists to distinguish individual fish as either hatchery or wild (naturally reproduced) fish. The findings indicated that for young walleyes in Saginaw Bay that about 80% came from stocking and 20% from natural reproduction. These results corresponded very closely to the other comparison that came from the nonstocking. From this, it was apparent that in fact Saginaw Bay's walleye population did benefit from some natural reproduction but that it was still heavily dependent on stocking.

Additional research evaluated the modern day rock reef habitat in the bay and how many walleyes it might still produce. The research found that that reef habitat in the inner bay (where spring water temperatures are the most suitable for walleye spawning) was badly degraded by sand and silt. The gravelly-rocky substrate that is necessary to keep walleye eggs exposed to water was now covered by fine material that wouldn't be as conducive to successful egg hatching. Apparently the sedimentation from erosion in the bay's watershed had reached out to the reefs and smothered them. Sampling on the reefs also showed few reef-spawning walleyes left and virtually no

Percentage of rock reef habitat



successful reproduction. This research confirmed that the source of walleyes in the bay was from either stocking or natural reproduction in the portions of rivers below first dams.

Lastly, additional research showed that Saginaw Bay's adult walleye population and fishery also benefited from immigration by walleyes from Lake Erie. Tagging studies in Lake Erie showed that a small percentage of fish migrated to Saginaw Bay each year and typically remained for the summer before returning. Although the percentage was small, because the Lake Erie walleye population was so large, it meant that thousands of walleyes were annually migrating to the bay. While this helped benefit the local fishery, by its self, this extra source of walleyes to the bay didn't allow the population or fishery to expand any further. Once Lake Erie was fully recovered, that source was at its maximum and there was no way to affect or encourage more immigration.

The Research begun in the 1980s provided lots of answers but the news was not always good. Although Saginaw Bay enjoyed some natural reproduction, it was still heavily dependent on stocking. Stocking was limited by the number of fingerlings that could be reared and the natural reproduction that existed was limited due to off-shore habitat degradation (on reefs) and limited access to spawning grounds in the rivers (because of dams). Still complicating matters too were large numbers of alewives in the bay which likely preyed upon some of the newly hatched walleye fry.

Designing a Recovery Plan.

Although not all the research findings had been good news, at least now biologists were armed with the information necessary to understand what limited expansion of the walleye population and fishery. They also had a improved measure of how far along the population was in the size of recovery compared to the carrying capacity of the bay. The DNR considered the progress made to date and concluded that more had to be done. Equipped with the research information, biologists could then begin to draft a series of options and strategies for finally finishing the job of walleye recovery. This information, and the ability to craft a recovery plan based on it, was the pay off for five million dollars and two decades of research investment.

Recovery goals and objectives.

Early in the writing of the recovery plan, DNR fishery research and management biologists first developed and articulated the exact recovery goals and objectives. They are:

Recovery Goals:

- To increase the abundance of walleyes in Saginaw Bay to the carrying capacity of the adult habitat and prey base.
- To achieve an ecological balance between predators and prey in Saginaw Bay with walleye functioning as the principle predator.

- For the above walleye population to be self sustaining (via natural reproduction).

The recovery objectives (how we actually measure the above) are:

- A density of walleyes (walleye numbers increase) such that the age-3 walleyes grow no faster than 110% of the state average growth rate.
- A population of walleyes capable of sustaining an annual harvestable surplus of 1 million pounds (same as the historic level).
- Above objectives to be achieved without dependence on stocking (stocking cessation or decrease only occurring after three year classes within five years meet or exceed a ratio of 50:50 wild to hatchery fish; see stocking strategy section to follow for further explanation).

This means that our long-term objective is to not only restore the abundance of walleyes in the bay, but to also have enough natural reproduction so that stocking is no longer necessary. Stocking, however, will be an important part of the recovery strategy until natural reproduction can increase to that level.

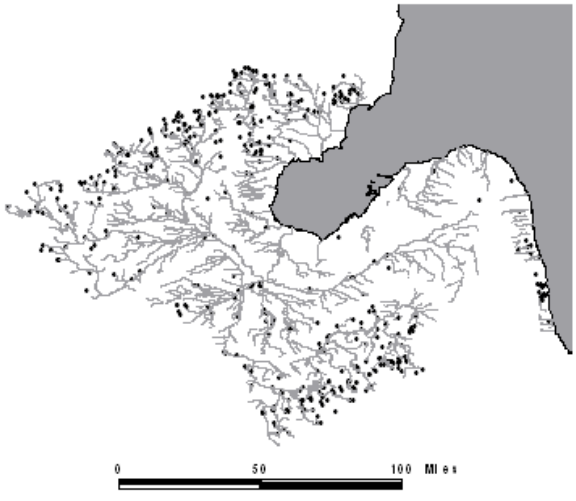
At first glance, the objective of slower growing walleyes (age-3 walleyes grow no more than 110% the state average) may not make sense to some. Currently, age-3 walleyes in Saginaw Bay grow at 128% the state average rate. This objective is really how the DNR will measure progress towards recovery. As the number of walleyes in the bay increase, they will slowly begin to make greater use of the food items (prey resource). That competition will lead to a declining growth rate. The same predictable pattern occurred in Lake Erie as that walleye population recovered. The thinking here is that some decrease in growth rate is an acceptable trade off in exchange for larger numbers of walleye. Large, trophy sized walleyes will still be available in the bay based on this approach by longevity and escapement from the fishery.

Recovery Plan strategies, what's actually going to be done.

Biologists considered many potential options for inclusion in the recovery plan. Choices were made based on what strategies were believed to most directly address the problems as they were defined by the research findings. Other criteria included making choices based on what was believed to pay the most dividends (most benefit) for further recovery investment. The strategy choices are;

Fish passage:

Research showed that the only place walleyes were successfully reproducing in the bay were rivers in the bay's watershed. More specifically, in the river reaches below the first dams. Presently, 72% of the length of the rivers in the bay's watershed is unavailable to migrating walleyes because of dams and spillways. If spawning walleyes could regain access to these river reaches, they should have more habitat to spawn on, and in turn, more young walleyes should recruit to the bay's population and ultimately the fishery.



Saginaw Bay watershed. Dots indicate the location of a dam or spillway obstacle.

The preferred option is to remove dams that block migrating fishes. That is often not possible because most dams are privately owned. In addition, many still serve a role in flood control, hydroelectricity production, and provide impoundments for waterfront homes. The reason dam removal is the preferred option is because it more completely restores access and the habitat. Often the best spawning habitat in the river were areas with the highest gradient (fastest flows) and that's typically where dams were originally built. In addition, dams make the safe transport of adults and fry back down stream more difficult. When and where dam removal is not possible, fish passage via ladders is sometimes an alternative. While not ideal, ladders to pass migrating walleyes up stream is a significant improvement in most instances.

There are nearly 300 dams in the Saginaw Bay watershed. The DNR has identified the following rivers as the initial priority for improved passage;

- Shiawassee River
- Cass River
- Pine River
- Chippewa River
- Tittabawassee River
- Flint River

The highest priority dams are those that constitute the first downstream barrier.

Specifically, the DNR will begin by:

- Seek engineering assistance to retrofit certain dams with fish ways or ladders capable of passing walleyes and other coolwater fishes. Begin with a pilot project at Dow Dam.
- Prioritize installation of fish passage based on location of the dam and the amount of habitat that would be reconnected, possibly via fry production model.
- Be prepared to capitalize on opportunities to remove dams within the Saginaw Bay watershed so as to pursue a long-term strategy of reconnecting entire river systems with the Great Lakes.

It is believed that while sometimes expensive and a long-term endeavor, that investments in fish passage have the potential to pay the greatest dividends for our recovery investment. Unfortunately, however, it is acknowledged that large scale gains in fish passage will probably not be realized for a period of decades. Consequently, additional strategies are deemed necessary to help achieve walleye recovery on the more near-term.

Increased walleye fingerling stocking:

Research determined that stocked walleye fingerlings survive very well in Saginaw Bay and contribute to the fishery. This provides a valuable tool to fishery managers. Increased walleye stocking can directly contribute to two of the three recovery goals (increase abundance to carrying capacity, and achieve predator / prey balance), and indirectly facilitate the third (increased natural reproduction). The way stocking can contribute to natural reproduction is not just by providing more spawners, but by serving to minimize the abundance of alewives in Saginaw Bay. Alewives are well known predators and competitors with newly hatched walleye fry. Alewives are also a common prey item by adult walleyes. By increasing walleye abundance artificially (through stocking), we can reduce one of the impediments to better walleye natural reproduction (alewives). Stocking has the additional benefit of being a management activity that the DNR has more direct control over compared to fish passage or dam removal.

The problem with increased stocking, however, is that all the walleye fingerlings produced in the state are currently being used. Research has indicated that for stocking alone to recreate the magnitude of a recovered walleye population, that as many as 5.8 million fingerlings would have to be stocked every year for 13 years! This is almost as much as the entire production of walleye fingerlings by the DNR. Researchers, however, have concluded that if walleye stocking could be increased to 2.5 million fingerlings total (an increase of 1.8 million fingerlings), that a significant increase in the adult population could be realized.

The dilemma is how to produce enough walleye fingerlings to increase stocking by another 1.8 million. Strategies will likely include obtaining or building some new rearing ponds in the Saginaw Bay area. Contributing strategies may include better optimizing current production to maximize fingerlings available for the bay. Long-term elements may also include the construction of more rearing ponds at existing hatcheries like Wolf Lake State Fish Hatchery. There will hopefully be opportunities to partner with willing stakeholder groups to develop, run and fund additional rearing ponds.

Reef reclamation:

Reclaiming reef habitat in the inner portion of Saginaw Bay to recreate a place for walleyes to spawn is an attractive idea. It directly addresses one of the known limiting factors. In this case, reef reclamation may include sediment removal as well as substrate placement. Substrate would be limited to natural gravel and cobble. This is in contrast to artificial reefs which sometimes make use of debris other than natural rock.

There are, however, secondary obstacles that make the idea of reef reclamation less certain. Even if eggs successfully hatched on a reclaimed reef they would still have to contend with predation by alewives. Until the alewife population is reduced, the benefit of reclaimed reefs would be minimal. In addition, research has indicated that there are few reef spawning strain walleyes left in Saginaw Bay. Its uncertain how well reclaimed reefs would be utilized unless a reef spawning strain was also reintroduced into the bay at the same time. Additional problems with reef reclamation is the uncertainty of its longevity. Its not known if on going sedimentation might degrade reclaimed reefs over time the same as it did the original natural reefs.

Even with these challenges, there may be a place someday for experimenting with reefs reclamation. Reef based walleye production would be a valuable means to diversify walleye recruitment in the bay. Reef reclamation may be most appropriate only in combination with, or subsequent to other strategies.

Sediment Control:

Because sedimentation has been such a source of habitat loss over the years, reductions in sediment loading in the watershed's rivers is an important part of the long-term strategy for providing for better walleye natural reproduction. Involved will be bringing the needs of fish and fisheries to the various agencies that currently deal with land management. This may involve partnerships among agencies and stakeholder groups. The DNR hopes to help identify and communicate sediment control priorities to land management and water quality agencies. In doing so, habitat improvement projects will achieve the greatest and lasting benefit. In turn, it is hoped to not only recovery the walleye population but to help prevent any reversal back to the same forces that originally degraded the habitat.

Recovery strategies considered but decided against for the time being:

Additional or different harvest regulations:

Harvest regulations such as season closures, length limits, and creel limits form one of the few tools that the Michigan DNR has more direct control over. There is no question that these are important elements of fish population conservation. Nearly all these harvest regulations, however, strive for the same objective; that is they seek to ensure enough spawning fish to continue the population. The reason additional or different harvest regulations are not a good fit for furthering walleye recovery in Saginaw Bay is because the obstacles to walleye recovery are mainly habitat driven and not a function of abundance of spawners. This has been borne out by the research findings. While new regulations could be implemented, they would only serve to further restrict fishing opportunity with no real benefit for enhancing walleye recovery. At present, the fishery subsists at entirely sustainable levels. Changes to walleye harvest regulations, however, might be more appropriate as recovery progresses and the DNR remains open to changes in the long term.

Alewife removal:

If alewives are part of the problem in walleye recovery, then why not remove them? This is a reasonable question given the place alewives play as a probable predator on newly hatched walleye fry. A removal operation, however, would be extremely costly and probably couldn't function without also extracting juveniles of game species and other desirable prey fish species. There is virtually no commercial market for alewives as well. While it is desirable to see alewives "removed" from Saginaw Bay, this plan seeks to achieve that through natural means, that is through walleye predation.

An adaptive management approach to walleye recovery:

An important part of this walleye recovery plan is the adaptive management approach being used. Adaptive management is simply a management style for natural resources that acknowledges the uncertainty surrounding the outcomes of management initiatives. Adaptive management says we'll carefully monitor the progress and effect of management efforts and if necessary, make changes to our strategies. This approach is based on a learning process. An important tenant of adaptive management, however, is to ensure that management initiatives are of bold enough size that their effects can be measured. This plan includes the continuation of the certain research studies to provide the feedback portion of the adaptive management approach.

Consequences of walleye recovery in Saginaw Bay:

Its worth noting the consequences of walleye recovery in Saginaw Bay as they may not all be positive. Positive consequences include:

- Vastly improved walleye fishing
- Eventual elimination of dependence on stocking; realization of the natural reproduction portion of the goal would free up hatchery resources.
- Reduction of over abundant prey (especially nonnative species like alewives)
- Ecosystem more resistant to the invasion of exotic species.
- Provide foundation for possible restoration of other native species.

Possible disadvantages might include;

- Increased predation on main basin prey resources (competition between walleyes and other sport species).
- Possible lower survival rate of stocked near-shore salmon and trout in Lake Huron due to walleye predation.

It is known that a small proportion of Saginaw Bay walleyes (like in Lake Erie) will emigrate or out-migrate from Saginaw Bay to the main basin and other near shore areas of Lake Huron. There is a potential for these walleyes to continue to eat alewives and compete with salmon for food. The overabundance of alewife situation in Saginaw Bay is not the same for the main basin where the prey base is fully utilized by salmon and trout. Research has shown, however, that the expected competitive effect is small.

Another potential problem is the possibility that emigrated walleyes may increase numbers in the near-shore areas along the Lake Huron coast. Past research has shown that walleyes are common predators on newly stocked salmon and trout smolts. There is the potential that survival rates of these stocked fish may be lower in the face of a fully recovered walleye population in Saginaw Bay. It is uncertain, however, the degree to which this would be a problem. Most ports up an down the main basin of Lake Huron already have local resident walleye populations. Walleye predation on newly stocked salmon and trout is already occurring. It is understood and expected that many of the stocked salmon and trout will be lost to predation and that's why so many are stocked to begin with. Still, a lower survival rate (if it occurred) would either mean additional smolts would have to be stocked to compensate or a lower overall survival would have to be endured.

Saginaw Bay alone amounts to 58% of all the fishing activity in the Michigan waters of Lake Huron.

By proceeding with the recovery plan, the DNR has decided that the potential benefits out weigh the possible draw backs. Saginaw Bay alone amounts to 58% of the fishing activity in the Michigan waters of Lake Huron and 86% of the sport harvest by numbers. It is believed that Saginaw Bay is far too important to compromise or defer fisheries management there relative to the possible negative outcomes described above. It is also held that the adaptive management approach will provide the opportunity to gauge the recovery process and its effects and make course corrections if necessary.

Time table

Its important to note that benefits of the different strategies will be realized in terms of years and even decades. Saginaw Bay was degraded over a time span of nearly a century and it will take time to finish the job of recovery. It is hoped that with public support, that the recovery effort will be kept a priority and gain momentum. Additional strategies may be announced in the years to come depending on the initial results and the resources available.

Conclusion

Unlike Lake Erie, Saginaw Bay's walleye population and fishery will not recover without further human intervention. Saginaw Bay has suffered habitat loss and species invasions that did not plague Lake Erie to the same extent. The Saginaw Bay situation is one that is much the opposite that of the main basin of Lake Huron where recent efforts have been to prevent over utilization of the limited prey base. Because Saginaw Bay and the rest of Lake Huron are distinct environments

different challenges and problems face each. Those same differences, allow them to be managed in different ways as well.

With determination, and with pubic support, walleye recovery can be realized in Saginaw Bay. The rate at which success if realized will largely depend on the level of pubic support received. In walleye recovery, Saginaw Bay can make a giant leap forward in return to its former grandeur and once again become a resource worthy of inheritance by future generations of Michiganders.

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