SEBAGO LAKE
LANDLOCKED ATLANTIC SALMON
MANAGEMENT PLAN

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SEBAGO LAKE LANDLOCKED ATLANTIC SALMON MANAGEMENT PLAN

The following plan was prepared in a format consistent with the "Classic Salmon" designation evaluation form" provided by the Sportsmen's Alliance of Maine. The plan strives to balance the expectations under Sebago's recent "Classic Salmon" designation, while also addressing the management concerns expressed by the local angling community.

Date last updated: _July 10, 2008_____
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Name of Water: __Sebago Lake_____ Fishery Region: A_

Town: _Raymond/Windham/Standish/Sebago/Casco_____
County:__Cumberland_____

Source of LLS Stock (indicate source with an X):

Native_Wild _ __
Introduced_Wild ___
Stocked _ __
Mix (stocked + wild)_X_

Smelt [Indicate predator/prey (LLS/SLT) ratio re growth & condition of LLS by placing an X opposite the appropriate category]:

Excellent: ___
Sufficient: _X_ (improving)
Poor: ___

Other forage (indicate species & importance):_____

Competition (List significant competitors (use 3-letter spp code) in appropriate blank based on importance. Place an X opposite None if no significant competitors are present:

High: __LKT_____
Moderate: __SMB, CSK_____
Low: _PIK**_____
None: ___

Predation : (List significant predators (use 3-letter spp code) in appropriate blank based on importance. Place an X opposite None if no significant predators are present):

High: _____
Moderate: _____
Low: ___LMB, PKL, LKT, PIK**_
None: ___

*** Note:** *Competition and predation ratings for Northern Pike will likely increase to moderate/high as the population from this recent introduction builds.*

Habitat Considerations:(describe pertinent habitat pluses, deficiencies, etc.)

Sebago Lake is well suited for landlocked salmon management. At 30,513 acres, it is the second largest lake in Maine and represents over 56% of the total surface water acreage managed for landlocked salmon within MDIFW's Sebago Lake Fisheries Management Region. The lake is unusually deep with an average and maximum depth of 107 and 316 feet, respectively. Water quality is exceptional, and the lake supports

a large volume of cold, oxygenated water. Summer dissolved oxygen levels exceed 5.0 ppm all the way to the bottom, and summer temperatures are suitable for salmonids below 25 feet.

The Crooked River and some of its tributaries provide excellent spawning and juvenile habitat for native landlocked salmon. Relatively little habitat is associated with other lake inlets and the outlet. Historically, numerous mill dams (Ede's Falls, Scribner's Mill, Bolster's Mill and two unnamed log dams in Waterford/North Waterford; listed in order of occurrence, starting with the lower most dam) on the main-stem of the Crooked River severally restricted access to spawning and nursery habitat for salmon. Furthermore, several of the aforementioned dams (Ede's, Scribner's and Bolster's dams) were located low in the river, restricting access for salmon spawning to only the lower most river areas, on a river that extends more than 50 miles. By the late 1980's, regional fisheries staff had successfully restored free passage throughout most of the Crooked River drainage and had begun to restore depleted salmon runs. Unlike most salmon waters in the region, salmon production in the Crooked River system contributes a significant number of wild fish to the lake fishery, ranging from 20% to 70%, depending on in-lake hatchery stocking rates. The lake fishery is supplemented with stocked hatchery salmon when available wild salmon production is insufficient to support relatively high use and demand for salmon fishing. The stocking of hatchery salmon also maintains an artificial "run" on the Jordan River to support MDIFW hatchery salmon production operations.

Free passage on the mainstem of the Crooked River is currently threatened (2008) by a proposal to rebuild the Scribner's Mill Dam, which could eliminate or reduce access to 65% of the available salmon-spawning habitat. Habitat inundation behind the proposed dam could also eliminate over 4% of the total parr salmon production within the main-stem of the Crooked River.

Recent illegal introductions within the drainage currently threaten Sebago's indigenous landlocked salmon fishery and complicate future management of all its coldwater fisheries. MDIFW confirmed the presence of Northern Pike in 2003, and although pike are not currently well established, there is evidence pike spawned successfully in 2005. Eventually, pike will become more abundant and compete more heavily for food/habitat resources, and as an opportunistic apex predator will prey upon littoral and pelagic fish in the lake, including landlocked salmon and smelt. In May of 2008 Eliot Stanley caught a 41-inch long northern pike that contained a 13 inch salmon in it's stomach. This finding generated considerable public interest and coverage by local news media. In addition to pike, MDIFW confirmed the presence of landlocked alewives in Pleasant Lake (Casco) in 2004, and in Raymond Pond (Raymond) in 2007. Alewives could drop down from either water and establish a population in Sebago Lake. Although nonnative landlocked alewives can serve as forage for salmonids and other sport fish, they may negatively interact with native rainbow smelt, which is the preferred forage of native salmon. Furthermore, there is evidence in the Great Lakes that landlocked alewives can reduce spawning success, survival and growth of salmonids, particularly landlocked salmon. In Sebago Lake, 100% of the lake trout population and a significant proportion of the salmon fishery (currently 70%) are comprised of wild fish.

Other Considerations:(historical significant population/fishery, genetically important population, social/traditional, etc.)

Sebago Lake is home to one of Maine's few indigenous landlocked salmon populations, making it both historically and genetically important. Sebago holds the distinction as a worldwide destination for salmon anglers since the early 1900's. Sebago also produced the current World Record Landlocked Salmon caught by Edward Blakely in 1907.

Rainbow smelt provide the critical forage that sustains the salmon and lake trout fisheries in Sebago. The presence of suitable forage is a pre-requisite for any quality landlocked salmon fishery. Like most smelt lakes, the smelt population in Sebago has periodically experienced large fluctuations in abundance, and historically exhibited a few relatively long-term periods of reduced abundance.

While Sebago Lake has historically produced quality landlocked salmon, it has also experienced several long-term declines in the quality of its salmon fishery. Available information immediately prior to the 1960's suggests the lake produced salmon of more average size, with an occasional salmon of larger size quality being caught. The first notable decline occurred during the 1960's and was largely attributed to the

wide spread use of DDT. DDT directly or indirectly impacted Sebago's fish populations and caused a significant crash in the lake's smelt population. The loss of smelt created a chain reaction that impacted other fisheries reliant upon them for forage. Eventually the use of DDT was banned and in response to several other fishery initiatives the salmon fishery recovered.

The second notable decline in the salmon fishery occurred in 1990, and was largely attributed to the Department's introduction of lake trout between 1972 and 1982. During this period over 300,000 lake trout were stocked; stocking was discontinued once a reproducing and self-sustaining population established. The new lake trout population continued to expand in the presence of abundant smelts and high quality habitat. Concurrent with this new population expansion, hatchery salmon were being stocked at elevated rates, and improved access to salmon spawning and nursery habitat in the Crooked River likely increased the wild salmon production and recruitment to the lake fishery. The aforementioned increases in lake predators placed considerable pressures on the smelt population. The burgeoning lake trout population and increased abundance of salmon exhausted the smelt population by the early '90's. Interspecific competition resulting from the newly established togue population was likely also responsible for the collapse of several other historical lake fisheries including lake white fish, white perch, and cusk.

During the period between the two aforementioned declines (1980's) evolved an era of unsurpassed fishing for unusually large salmon and lake trout. The fishery was short lived, although the lake trout catch continued to skyrocket between 1988 and 2002. Most anglers refer to this period as the "good old days", when 3 to 5 pound salmon were commonplace and as some anglers recall, "you didn't hardly catch a togue less than 5 pounds".

The 1970's and 1980's was also an era of growing environmental awareness, with the inception of new environmental protection programs at the state and federal level. Some of these new programs focused on improving and protecting water quality. For example, water quality protection programs prompted the elimination of two direct municipal discharges into Long Lake, which drains directly into Sebago. Increased environmental protection and declining agriculture and associated runoff may have reduced the historical nutrient inputs into the lake, and may also have reduced the primary productivity and fish production potential of Sebago. Relatively recent water quality monitoring since 1990 by the Portland Water District suggests a recent pattern of increasing primary production, but available data appears to be inadequate to assess more long-term historical changes.

In response to the smelt decline in 1990, the MDIFW employed a variety of techniques to improve the salmon and lake trout fisheries. These efforts included regulatory, stocking, and other corrective provisions. Table 1 summarizes a progressive liberalization of recreational lake trout regulations designed to increase lake trout harvest and enhance smelt recovery.

Table 1. History of Recreational Fishing Regulations for Sebago Lake, 1986-2011.

Year	Open water Regulations	Ice Regualtions
1986	1-line limit, 2-LLS (min.16"), 2-LKT (min. 18")	2-line limit, 2-LKT, closed to LLS
1990	1-line limit, **1-LLS** (min.16"), 2-LKT (min.18")	"
1994	**2-line limit**, 1-LLS (min.16"), **3-LKT** (min.18")	2-line limit, **3-LKT**, closed to LLS
1995	"	2-line limit, 3-LKT, closed to LLS, **closed the taking of SLT**
1996	2-line limit, 1-LLS (min.16"), 3-LKT (min.18"), **closed to the taking of SLT**	"
1997	"	2-line limit, **5-LKT (min. 16")**, closed to LLS, closed the taking of SLT
1998	2-line limit, 1-LLS (min.16"), **5-LKT (min.16")**, closed to the taking of SLT	"
2002	2-line limit, 1-LLS (min.16"), **6-LKT (min.14", only 1>23")**, closed to the taking of SLT	2-line limit, **6-LKT (min.14", only 1>23")**, closed to the taking of SLT & LLS
2004	"	**5-line limit**, 6-LKT (min.14", only 1>23"), closed to the taking of SLT & LLS
2005	"	**"**

2006	"	"
2007	"	"
2008	2-line limit, 1-LLS (min.16"), **6-LKT (min.14", only 1>23")**, LKT may also be harvested Oct 1 – Dec 31, closed to the taking of SLT	"
2009	"	"
2010		**5-line limit**, 6-LKT (min.14", only 1>23"), closed to the taking of SLT & LLS, LLS must be released without removal from water
2011	"	"

In addition, MDIFW progressively reduced the salmon-stocking rate (Table 2) between 1988 and 2005 to further reduce smelt predation, and also reduce intraspecific competition with wild salmon. The annual stocking of salmon was eventually reduced to 1000 fish in 2002. Stocking would have been all together cancelled, but a small stocking program was maintained to support the hatchery's egg take operation on the Jordan River, which provides hatchery salmon for stocking programs in southern and central Maine.

Inland smelt eggs were transferred between 1994 and 2001, and sea-run smelt eggs were experimentally introduced between 2002 and 2006 in an effort to augment the depressed smelt population and expedite a recovery.

Table 2. LLS Stocking History for Sebago Lake, 1988-2011.

Year	*No. FF Stocked	*Effective FF Stocking to Reflect SY Survival	No. SY Stocked	Absolute No. LLS Stocked (SY + FF)	Adjusted Annual Stocking Rate to Reflect FF Survival
1988	20,000	2859	3,278	23,278	6,137
1989	18,000	2571	0	18,000	2,571
1990	18,000	2571	7,200	25,200	9,771
1991	18,000	2571	7,200	25,200	9,771
1992	0	0	9,000	9,000	9,000
1993	0	0	9,000	9,000	9,000
1994	0	0	3,000	3,000	3,000
1995	0	0	4,000	4,000	4,000
1996	0	0	4,000	4,000	4,000
1997	0	0	4,100	4,100	4,100
1998	0	0	6,250	6,250	6,250
1999	0	0	7,000	7,000	7,000
2000	0	0	4,000	4,000	4,000
2001	0	0	4,000	4,000	4,000
2002	0	0	1,000	1,000	1,000
2003	0	0	1,000	1,000	1,000
2004	0	0	1,000	1,000	1,000
2005	0	0	1,000	1,000	1,000
2006	0	0	2,000	2,000	2,000
2007	0	0	2,500	2,500	2,500
2008	0	0	3,500	3,500	3,500
2009	0	0	3,000	3,000	3,000
2010	0	0	2,500	2,500	2,500
2011	0	0	2,500	2,500	2,500
* Post stocking fall fingerling survival was very low; 7 fall fingerlings to equal the survival of 1 spring yearling.					

Hydroaccoustic surveys indicated a 20-fold increase in smelt abundance between 2001 and 2006; the rate of population growth was best described as exponential. Responding to increased available forage, salmon

size and growth improved. As a result of improving conditions, a modest increase in salmon stocking occurred in 2006, 2007, and 2008. Conservative adjustments to annual stocking are intended to encourage a stable and sustainable fishery characterized by fewer fluctuations in forage abundance and sportfish quality. The use of modest incremental stocking adjustments is further warranted because stocking needs must be identified 2 years in advance, and wild salmon recruitment to the lake fishery is unpredictable from year to year.

MDIFW has been involved in several other management initiatives to restore the salmon fishery in Sebago Lake:

- Assessing the use of gillnets as a means to remove lake trout and the affects on by-catch;
- Investigating the potential use of lake draw downs to suppress lake trout spawning;
- Evaluating the effectiveness of boat electrofishing for lake trout capture during spawning;
- Enhancing opportunities to reduce the negative influence of beaver dams on salmon spawning;
- Assessing/monitoring an illegal introduction of northern pike;
- Removing fish passage impediments on the Crooked River and its tributaries;
- Coordinating the development of an annual plankton monitoring program to assess trends in lake productivity (PWD/SLAA);
- A partnership with SMCC and SLAA to experimentally introduce and evaluate the success of an experimental sea-run smelt egg transfer project;
- Encouraging/facilitating creative opportunities to exploit lake trout (i.e., Windham Rotary's Sebago Lake Ice Fishing Derby).

The smelt, salmon, and lake trout populations have shown strong signs of improvement since 2001. Despite these gains, the lake's potential for producing quality salmonid fisheries has not yet been fully realized. Furthermore, the system remains in a state of instability and may still be somewhat fragile.

In summary, Sebago Lake is the largest lake in the region (2nd largest in Maine), it supports an indigenous salmon population, excellent water quality, a smelt forage base, and a history of producing quality-sized landlocks. Its large size and great depth are ideal for pelagic species like salmon, and perhaps even better suited for competing lake trout. Sebago has the potential to produce good numbers of above-average size salmon, but may not approach historical levels of production in the future. The presence of a robust and competing lake trout population, and recent illegal introductions will likely continue to negatively impact future salmon management efforts.

Current Regulations (list applicable regulations):

Open water:

- Lake fishing ends December 31 (new for 2008), BUT salmon may not be taken after September 30th.
- Lake Trout - daily bag limit: 6 fish; minimum length limit: 14 inches, only 1 may exceed 23 inches. Lake trout may be harvested from Oct 1 through Dec 31 under the new (2008) extended fall fishing regulation.
- Salmon – daily bag limit: 1 fish; minimum length limit: 16 inches.
- Lakes and rivers closed to the taking of smelt
- Station area is open to fishing from 10/1-11/30 with the following conditions: FFO, barbless hooks, catch-and-release (remains listed in the 2008/2009 law book, but is effectively replaced by new fall fishing regulation that allows fishing until December 31).
- Southern portion of the lake is closed to boating/fishing due to the presence of the Portland Water District intake.

Crooked River:

- Closed to the taking of smelt.
- Route 35 in North Waterford to Rte. 11 in Casco, April 1 to September 30: FFO; daily bag limit of salmon - 1 fish; minimum size limit of salmon – 26 inches.
- Bolster's Mill Road Bridge to Rte. 11 Casco, October 1 to October 15th: FFO; daily bag limit of salmon - 1 fish; minimum size limit of salmon – 26 inches; all other fish caught must be released alive at once.

Ice:

- Class B – closed to ice fishing until January 1 and then open from 1/1 to 3/31.
- Lake Trout - daily bag limit: 6 fish; minimum length limit: 14 inches, only 1 may exceed 23 inches.
- Closed to the taking of trout and salmon through the ice.
- Lake and tributaries closed to the taking of smelt.
- Specific area(s) of the lake are closed to fishing and motor vehicle use due to Portland Water District intake.

Proposed Regulations:

- **Lake Trout:** Continue to examine the need for changes in lake trout fishing regulations that reduce lake trout abundance and improve lake trout size quality. Potential regulations could include further increases in bag limits, as well as provisions that promote top-down "biological control" of the lake trout population by protecting the largest togue. Emerging research suggests, "top down control", which favors an increase in the abundance of larger, older-aged fish may regulate population size and recruitment through intraspecific interactions. This approach favors the development of a more natural age class structure associated with unexploited populations. This approach is consistent with the desired goal to reduce lake trout densities and offers an added benefit of enhanced lake trout size quality.

  A new regulation in effect for 2008 allows open water anglers to fish for and harvest togue for an additional 3 months during the fall (Oct-Dec).

- **Landlocked Salmon**: The need for regulations to enhance the size quality of stocked and wild landlocked salmon must be balanced by other management considerations, including the public's desire for increased salmon abundance and associated catch rates. The implications of various types of restrictive salmon length limits on salmon stocking rates and wild salmon production are outlined below, subsequent to a brief discussion of salmon growth and maturity to assist with understanding various "Regulation Options".

  Salmon stocked as spring yearlings (8 – 10 inches long) in Sebago may reach 16 inches (minimum length limit) by the end of their first summer at large (when smelt forage is not limiting), with most being vulnerable to harvest by the following spring at age 2+. Two-year-old wild juvenile salmon that migrate to the lake from the Crooked River may not reach 16 inches until age 3+. The vast majority of adult wild salmon captured at the Bolsters Mills fishway in 1985 and 1986 ranged between 17 and 20 inches in length. An analysis of scales collected from wild salmon indicates age 3, 4, and 5 salmon dominate the wild salmon spawning population.

  Regulation Options:

a) ***16-inch minimum length limit (currently in place):*** The current regulation provides protection to stocked and wild salmon during their first summer in Sebago (when smelts are abundant). The 16-inch limit alone does not appreciably encourage escapement to older age and larger size. The existing 1 fish bag limit for salmon and high angler catch and release rates (70% in 2006) also favor escapement to older age. Moreover, large lake size is likely very important in determining escapement and survival to older age.

   The 16-inch minimum length limit posses a relatively low level of risk (slightly greater than that offered under general law; 14" minimum) to the smelt population from over grazing and with the exception of general law length limits, offers the quickest recovery should smelt abundance decline. The 16-inch limit increases opportunities to maximize annual salmon stocking rates, minimizes predation pressures on smelt, offers some protection to wild salmon, and historically has allowed salmon of excellent size quality to develop consistent with the goals of the Classic Salmon Initiative.

The current regulation allows for some salmon harvest before sexual maturity is attained, and consequently does not enhance wild salmon production as well as some other regulatory approaches discussed below. The current minimum length regulation also may not enhance the size of the Jordan River spawning run, which constitutes the brood source for southern Maine's hatchery stocking programs. The current 16-inch minimum length regulation does enhance opportunities to conserve and manage a sustainable smelt population.

b) ***Higher minimum length limits*:** Increasing the minimum length limit on salmon from 16" (current) to a minimum between 18 and 20 inches is another regulatory option. The 18 to 20 inch range corresponds with expected growth (in length) of a hatchery fish after two full open water seasons in the lake, assuming smelt are abundant. Under the current 16-inch minimum, stocked salmon would attain legal size and be vulnerable to harvest by the end of the first open water season or by the start of the second. Under a higher minimum length limit salmon are protected through their entire second open water season at large. These potentially 2 and 3 pound salmon would not be subject to harvest until their 3rd summer at large, increasing the proportion of 3 to 4 pound salmon available in the sport fishery, assuming smelt are abundant. Because higher numbers of larger salmon would be retained in the lake, they would increase predation pressures on smelt forage. More conservative stocking rates would be required to offset anticipated declines in smelts caused by increasing the proportion of larger, older aged salmon.

An advantage of a higher minimum length limit is an expected increase in the number of wild salmon that reach sexual maturity and spawn in the Crooked River. Increased reproductive potential would increase wild salmon recruitment to the lake fishery, as well as the river fishery. Although, increasing the wild salmon population is expected to increase forage pressures on smelt, necessitating conservative hatchery stocking programs to maintain growth and attainment of size quality performance standards.

Annual variations in wild production are expected to occur naturally and unpredictably. This may create unpredictable fluctuations in the quality of the lake's salmon fishery. This uncertainty complicates efforts to maintain a consistent fishery from year to year.

Lower conservative stocking rates under a higher minimum length limit may also increase returns to the fish trap on the Jordan River, which provides the brood source for hatchery salmon production in southern Maine.

Under the right circumstances, higher length limits could enhance wild salmon recruitment to the fishery, improve overall size quality of salmon in the fishery, and increase the brood supply on the Jordan River. However, higher length limits greatly increase the potential for over-grazing the smelt population and also delaying a recovery from such a collapse. Higher size limits must be combined with very conservative stocking practices to maintain forage, and anglers should expect much more year to year variability in salmon catch rates because wild salmon numbers will fluctuate.

c) ***Maximum length limits*:** Maximum length limits preclude the harvest of fish that are larger than a certain size (i.e., 20"). Smaller salmon, say between 16 and 20 inches could be harvested. Maximum length limits permit the conservative harvest of younger, fast-growing fish and preclude harvest of the largest fish in the population. There is an expectation that large fish would be "recycled" in the fishery.

This type of a regulation increases the potential to recruit and maintain larger numbers of "trophy-size" salmon in the fishery. One obvious drawback is that larger salmon, including trophy salmon could not be harvested; however, more individual anglers would have the opportunity to catch and release a trophy salmon.

A high maximum length limit posses less risk to over-grazing the smelt population in comparison to a higher minimum length limit and only slightly greater risk (extent of the impact and recovery time) than the current 16-inch limit. Furthermore, a high maximum length limit is not expected to

increase the size of the wild adult salmon run to the extent that would occur under a higher length limit. Maximum length limits would offer modest increases in wild salmon to the lake fishery, as well as to the Crooked River fishery. The presence of larger older-aged salmon in the Jordan River spawning run may increase total egg take, but not necessarily significantly increase the number of mated pairs. Conservative hatchery stocking rates would still be required under a maximum length limit, but less conservative than that required under a higher length management strategy.

d) ***Slot limits*****:** Slot limits would function similar to the maximum length limit, except that the very largest trophy salmon (say larger than 25") could be harvested. So, for example, fish between the maximum length limit (say 20") and a higher trophy limit (25") would have to be released, while salmon between say 16 and 20 could be harvested. This approach, although more complicated for anglers to interpret and comply with, would offer many of the same advantages and disadvantages realized under a maximum length limit, except fewer fish would be available to be recycled in the fishery. Conservative salmon stocking practices would still be required under slot management.

e) ***General law (14 inch minimum):*** This regulation provides very limited protection to stocked and wild salmon during their first season at large in Sebago. The general law length limit allows harvest of wild and stocked salmon generally soon after entering the lake (usually within 3 to 6 months), and before sexual maturity is reached, a potential concern for wild salmon. General law encourages early harvest where angler pressure is moderate to high, maximizing growth rate potential for individuals not harvested in the fishery, while providing good catch rates and harvest opportunity for younger faster growing salmon. This regulation, in and of itself offers little protection to maturing wild salmon. However, a regulation that offers rapid removal from the fishery reduces pressures on the smelt forage population, potentially results in reduced salmon densities, but optimizes growth rates on remaining unharvested salmon. Regardless of the length limit established on Sebago, high angler catch and release ethic and large lake size will have a considerable positive influence on salmon survival in Sebago Lake.

On other area lakes where angler use is moderate to high, particularly where lake size is small to moderate, general law regulations have been very effective in the development of successful salmon fisheries. Under these circumstances, most general law waters offer some quality size salmon in the 4 to 5 pound range, and optimize angler catch rates for smaller faster growing fish. However, this regulation does not appreciably increase escapement of a significant number of individuals to older age and larger age classes, particularly in smaller waters. As such, this regulation, in and of itself would not offer the level of protection to wild maturing salmon in Sebago that higher minimum length strategies would offer. Also, a 14-inch minimum length would offer less size quality development opportunity than that offered by higher length limits.

Of the regulations discussed, the 14-inch minimum length limit posses the lowest level of risk to the smelt population from over grazing and offers the quickest recovery should smelt abundance decline. The 14-inch limit maximizes opportunities to increase annual salmon stocking rates, but offers the least amount of protection to maturing wild salmon, allowing harvest well before sexual maturity is reached. The harvest of immature wild salmon could influence wild salmon production and recruitment to the fishery. This regulation would also not enhance the size of the Jordan River spawning run that provides the brood source for southern Maine's hatchery salmon programs. However, the size quality objectives under the Classic Salmon Initiative could be achieved under general law, considering prevalent angler catch and release practices, and Sebago's large size and opportunity for escapement.

f) Additional regulation suggestions presented by the public during review of the draft salmon plan include the use of more liberalized bag limits, winter angling opportunities, and differential regulations for wild and stocked salmon.

Expanded salmon harvest opportunities, either under higher bag limits during the open water fishing season or by allowing winter harvest (currently prohibited) would likely reduce the salmon catch rates. Winter harvest would reduce the number of salmon available to open water anglers,

resulting in reduced open water salmon catch rates. Most of the best regional salmon fisheries, in terms of catch rates and size quality occur on those waters where ice fishing for salmon is prohibited or restricted. Restricted season and low bag limits can contribute to increased survival and abundance of larger sized salmon. Management on Sebago under the Classic Salmon initiative favors the open water angling experience, so expanding harvest opportunities during the winter is not consistent with proposed management. Should wild salmon in Sebago become too abundant and characterized by poor growth and size quality, then strategies favoring increased harvest opportunity could be considered.

More protective regulations designed to increase survival and spawning success of wild salmon, while allowing more harvest opportunity for stocked salmon has some biological merit. However, issues associated with enforcing regulations where Wardens and anglers must distinguish between wild and stocked salmon is potentially problematic. A unique fin or combination of fins is/are removed from each stocked salmon each year to allow salmon returns to be readily aged in the field in support of biological monitoring. It has been suggested that since stocked salmon are "fin-clipped" and wild salmon retain all their fins, the absence of any missing fins could be use as a means to distinguish wild from stocked salmon. Therefore anglers would have a means to identify wild fish. In theory this approach is plausible, but some contend fins from wild salmon could be removed from angled wild fish, and warden service staff have expressed concerns regarding their ability to effectively enforce regulations that apply only to wild salmon. This approach, if enforceable would provide a means to enhance Sebago's wild salmon stocks and improve size quality of wild salmon. However, such regulation change should not be considered until the smelt population can support additional foraging predation from salmon held longer in the fishery. Some reductions in hatchery stocking may be needed to compensate for the increased predation of wild salmon on smelt. If the use of higher salmon length limits is considered in the future there should be a more thorough discussion and debate whether wild salmon could be enforceably managed under different regulations.

In summary, new regulatory strategies to manage Sebago salmon would result in a number of "trade offs", or what some might consider advantages and disadvantages. Potential future use of one of the more restrictive regulatory options discussed should consider the following tradeoffs outlined in the table below.

Advantages and Disadvantages of More Restrictive Salmon Length Limits	
Perceived Advantages	**Perceived Disadvantages**
• Could increase salmon survival in the lake to larger size, if smelt are abundant • Would likely increase wild salmon abundance in the lake • Would likely increase wild salmon abundance in the Crooked River • Could likely increase wild salmon production in the river and recruitment to the lake • Greater wild salmon production would reduce IFW hatchery stocking costs	• Would increase risk of over grazing smelt and population collapse • Would delay the recovery from a collapse of the smelt population. • Wild salmon recruitment is highly variable and unpredictable, and could produce more variable fishing from year to year • Hatchery salmon stocking rates would be reduced to compensate for increased wild salmon production and increased predation on smelt.

New salmon regulations are not recommended at this time. The following rationale support this recommendation: 1) past success with the current salmon regulation in producing quality size salmon; 2) the fragile and unstable state of the current recovery; 3) successful development of quality salmon fisheries in other area waters using relatively low minimum length limits; 4) high voluntary angler release rates; 5) perceived public desire for increased salmon production/stocking rates; and 6) the effective preservation of the wild salmon population. The existing salmon regulations, educational signage ("Set The Wild Ones Free") encouraging anglers to release wild salmon, proposed lake trout regulations, and other enhancement provisions (to be discussed) offer

a conservation strategy to maintain and enhance the wild salmon population, while balancing other angler expectations. The implementation of a high minimum length limit, slot limit, or maximum length limit in the future may further enhance salmon size quality, but should only be considered if the smelt population remains stable and abundant. Of the more restrictive regulation types discussed, maximum length limits pose the least risk to maintaining a stable smelt population. The 14-inch and current 16-inch length limit posses the least risk to the sustainable management of smelt of all the regulation strategies discussed. Furthermore, the current high angler release rate could reduce the effectiveness of more restrictive regulations. Should more restrictive salmon regulations be considered in the future, it would be necessary to encourage the harvest of legal size stocked salmon; otherwise the risk of overgrazing smelt is increased.

Identify Individuals/Group(s)to Contact for Input and/or Support:

- Sebago Lake Anglers Association (SLAA)
- Windham/Gorham Rod and Gun Club
- Pine Tree Rod and Gun Club
- Sebago Chapter of Trout Unlimited (TU)
- Larry Fiori, Sportsman's Alliance of Maine

ACTION PLAN

The plan places a primary emphasis on salmon management (particularly wild salmon), although efforts, which benefit the successful development of a quality salmon fishery, may also benefit other sportfish (i.e., cusk) considered of secondary importance to the lake angling community. Periodically the plan may be revised and updated to reflect new information and issues of concern.

The goal of the Classic Salmon Initiative is to maximize the water-specific growth potential for salmon and thereby increase the number of 5 pound and larger salmon in the fishery. This actual goal as it applies to Sebago Lake considers such factors as historical growth and performance, lake productivity, water quality, forage, competition from introduced species, and angler expectations.

The Department proposes to increase the proportion of 3 to 4 pound salmon in the fishery, with the expectation that some larger salmon in the 5-8 pound class would also be produced. This will require careful, thoughtful management of all the lake's smelt predators, including salmon and lake trout, and special consideration extended to protection of the indigenous salmon population. Management will rely upon conservative salmon stocking practices, enhancing wild salmon production, and reducing lake trout population size.

Management favoring salmon of large size quality can result in low angler catch rates. However, a fishery characterized by low salmon catch rates, regardless of the salmon size quality provided will not be acceptable to the majority of anglers fishing Sebago. Therefore, management will favor an approach that provides acceptable catch rates for salmon of a size that the Department believes the lake can produce under current and projected biological conditions. This approach will provide greater assurances that salmon catch rates will be sufficiently high to maintain angler interest over a broader range of salmon growth performance. This approach also favors use of slightly higher salmon stocking rates, a desire expressed by the public, unless increases in wild salmon production offset the need for stocking. Salmon management would focus exclusively on the open water angling experience, and the following strategies reflect an approach that is most likely to succeed:

Management Goal: Develop and maintain a sustainable landlocked salmon fishery characterized by higher size quality and greater abundance, so as to provide a more equitable allocation between the salmon and lake trout angling community.

SEBAGO LAKE LANDLOCKED ATLANTIC SALMON MANAGEMENT PLAN

Management Objectives: (1) Sustain an abundance of smelt consistent with the lake's carrying capacity and limit annual fluctuations; (2) reduce the competing lake trout population; (3) limit the threat to smelt and landlocked salmon (predation/competition) from illegally introduced aquatic organisms (northern pike & landlocked alewives) within the drainage; (4) maintain and where practical enhance the contribution of wild salmon to the lake and Crooked River fishery; and (5) supplement the wild salmon fishery with hatchery fish when forage, wild salmon production, salmon growth, and angler exploitation support increased stocking; (6) sustain high salmon growth rates to the extent practical to maximize growth potential, while considering the need to maintain acceptable salmon catch rates.

The following action items (1, 2, 3….) support attainment of management objectives and are listed in order of priority.

1) *Sustain an abundance of smelt consistent with the lake's carrying capacity and limit annual fluctuations.*
   a) Collect age and growth information from Jordan River salmon to provide an indirect measure of smelt abundance.
   b) If practical and necessary, augment severely depressed and recovering smelt populations by stocking smelt eggs to jump-start or accelerate recovery efforts following a catastrophic decline. Long-term supplemental forage stocking is not recommended. Long-term smelt management will focus on the establishment of a self-sustaining forage population consistent with the lake's carrying capacity.
   c) Adjust salmon stocking rates to reduce predation on smelt when necessary to rebuild smelt stocks, and/or to reduce intraspecific competition with wild salmon.
   d) Determine the effect and contribution from previous experimental sea-run smelt egg transfers on rebuilding lake smelt stocks.
   e) When sufficient PWD data is available, correlate plankton biomass with smelt biomass to identify additional relationships useful in managing lake fisheries.

2) *Reduce the competing lake trout population.*
   a) Explore/Adopt a regulation strategy that encourages "top down control" to biologically limit lake trout recruitment and survival, and encourage directed recreational harvest at younger age classes as a primary means to reduce lake trout abundance. The current lake trout regulation format that utilizes a "one over" provision (daily bag of 6 lake trout, minimum length 14 inches, only 1 over 23) is consistent with lake trout reduction objectives. The fall fishing regulation adopted for the 2008 fishing season will increase togue harvest opportunity by allowing togue to be harvested by anglers from October through December.
   b) Post spawning, early winter water levels reductions (6 feet) offer promise to reduce lake trout spawning success, but recent efforts by MDIFW to advance this management recommendation were not embraced by FERC in it's issuance of a license for the operation of Eel Weir Dam at the outlet of Sebago Lake. Reinvestigate in the future.
   c) Support lake trout fishing derbies on Sebago, which provide additional recreational harvest and population reduction opportunities for lake trout.
   d) Explore other recreational opportunities to increase lake trout harvest opportunity.
   e) If practical and necessary as a last resort, explore methods other than recreational fishing to reduce lake trout abundance.

3) *Limit current and future threats (predation/competition) from illegally introduced fish, like northern pike & landlocked alewives, as well as other invasive organisms within the Sebago Lake drainage which adversely impact smelt and landlocked salmon*
   a) Increase public awareness and outreach regarding existing potential threats (public forums, signage, written media, etc) and potential future illegal introductions.
   b) Implement action items contained in the "Threat Analyses" completed for northern pike and landlocked alewives, including a careful review of cost effective mitigation options.

c) Encourage exploitation of existing present threats (northern pike).
d) Monitor illegal introduction threats (angler reports, voluntary angler fishing log books, etc) to quantify trends in population and potential risk to coldwater fisheries.

4) *Maintain and where practical enhance the wild salmon contribution to the Sebago Lake and Crooked River fishery*
   a) Prevent the construction of any new dams (i.e., Scribner's Dam) and where possible enhance fish passage at an existing "obstructions, that would adversely impact salmon passage and habitat for adult and juvenile salmon (i.e., Scribner's Dam).
   b) To the extent practical identify and correct salmon passage impediments associated with road crossings.
   c) Reduce intraspecific competition between stocked and wild salmon to maintain good growth rates to ensure wild salmon are in good spawning condition. Size and growth performance standards will favor attainment of good growth. Reduced stocking of hatchery-reared salmon may be necessary to meet growth and size performance standards.
   d) Monitor salmon reproduction at least biannually (once / 2 years) at designated index sites in the Crooked River drainage. Future assessment methods will rely upon a habitat-based model to estimate annual salmon production and recruitment to the lake fishery.
   e) Determine the rate of survival from parr to smolt stage (in the Crooked River) to improve the accuracy of smolt production estimates described under "d" above.
   f) Measure smolt production for at least two years to calibrate the model developed to estimate smolt production.
   g) Quantify spawning and nursery habitat in high salmon use tributaries of the Crooked River to comprehensively assess salmon production potential within the entire Crooked River drainage.
   h) Reduce the beaver population within the Crooked River watershed through directed recreational beaver trapping at surveyed, GPS-referenced colonies to enhance available salmon spawning and nursery habitat and provide unobstructed access to that habitat.
   i) Reduce/eliminate ADC-relocated beaver releases within the Sebago Lake drainage, particularly the Crooked River. This measure will further reduce beaver colonization rates and associated concerns.
   j) Maintaining the current 16-inch minimum length limit on salmon provides needed flexibility in balancing current social and biological concerns.
   k) Nonregulatory measures that encourage anglers to release wild salmon ("Set The Wild Ones Free" sign) will continue in an effort to balance stated public concerns (stock more fish vs. enhanced wild salmon production)
   l) Explore additional opportunities to directly monitor the adult wild salmon run in the Crooked River.
   m) Support stewardship efforts to develop conservation easements and property acquisitions on lands abutting the Crooked River and its headwater tributaries.

5) *Size quality performance standards for salmon*. Adjust salmon stocking rates consistent with the attainment of the following salmon size-quality performance standards: a) maintain adult male salmon condition factors (Fulton K) greater than 0.90; b) maintain a mean length and weight for age II+ male stocked salmon (Jordan R sample) between 18 and 20 inches, and 2.2 to 2.7 pounds, respectively; c) maintain a mean length and weight for age III+ stocked male salmon (Jordan R sample) between 20 and 23 inches, and between 2.8 to 4.3 pounds, respectively. For reference, in 1988 (when most anglers consider the fishery to have peaked) Age II+ stocked male salmon averaged 18.8" and 2.2 lbs, with a Fulton K value of 0.9. Age III+ male salmon at that time averaged 21.8", 3.5 lbs, with a Fulton K value of 0.94

6) *Catch rate performance standards.* Management should maintain acceptable salmon catch rates, while striving to attain size quality objectives. Efforts to maintain acceptable salmon catch rates may on occasion compromise efforts to produce larger salmon, because unusually low catch rates will not be socially tolerated for significant duration on Sebago Lake. Management will strive to seek an acceptable balance between size quality and catch rate, which are typically inversely related. Management will strive to maintain season-long catch rates higher than 0.035 salmon (legals +

sublegals) per hour (28 hours to catch a salmon). For reference or comparison, the salmon catch rate in 1988 was 0.05 salmon (legals+ sublegals) per hour, which equates to a calculated catch of 1 salmon for 20 hours of fishing. Since these rates reflect angler surveys where salmon and lake trout fishermen were not differentiated, the calculated rates grossly overestimate the time actually required to catch a salmon by anglers targeting salmon. For example, angler clerk data collected in 2006 indicated a season-long salmon catch rate of 1 salmon every 21 hours of fishing time (0.047 salmon per hour), but anglers targeting salmon (based on voluntary record logbooks) reported catching 1 salmon every 8 hours. Angler creel surveys will be conducted every 2 to 3 years to obtain catch rate information for trend analysis.

7) *Stocking hatchery reared salmon.* Annual salmon stocking rates will be adjusted higher or lower depending on the abundance of salmon forage (smelts), salmon size quality, angler catch rates, and other important considerations including but not limited to wild salmon recruitment and regional hatchery production needs. It is unlikely salmon stocking rates will ever reach their historical levels due to current circumstances, including: 1) heavy competition from lake trout; 2) increased negative interactions expected from northern pike (heavy predation of salmon and not smelt may actually result in increased stocking); 3) an increased focus on salmon size quality under the Classic Salmon initiative, which favors reduced hatchery salmon stocking and catch rates to attain high size quality; 4) improved salmon access to spawning and nursery habitat in the Crooked River since the late 1980's, and associated potential gains in salmon production, and the desire to maintain a healthy wild population. Size quality and catch rate performance standards will guide decisions regarding whether to increase or decrease salmon stocking rates. When conditions are favorable stocking rates will be incrementally increased until smelt abundance declines and/or salmon size quality performance standards are in jeopardy of not being attained. Catch rate performance standards will also be considered in relation to changing angler use and effort directed at salmon.

Table 2 provides a stocking history since 1988. Anglers commonly reference the perceived high salmon stocking rates between 1988 and 1991. During this time period Sebago was subject to an investigation comparing the survival of spring yearling and smaller fall fingerling salmon, which were stocked at much higher rates in anticipation of high mortality. Survival was based on the proportion of each age class that entered the legal fishery. It was determined that 7 fingerlings would need to be stocked to realize the survival of one spring yearling salmon. As a result, the last column in Table 2 denotes an adjusted stocking rate to reflect the high mortality associated with fingerling stocked salmon. The adjusted numbers indicate that during this 4-year time period the effective stocking rate ranged between 6,137 and 9,771 spring yearling salmon. The smelt population and the salmon fishery it supported subsequently crashed, and was attributed to high salmon stocking rates, increased wild salmon production, and an exploding lake trout population.

During the aforementioned study period, the salmon stocking rate equated to approximately 0.3 spring yearling salmon per surface acre of lake habitat. This stocking rate is commonly applied on other successful regional salmon waters that lack salmon reproduction, heavy competition from lake trout, and restrictive salmon bag and length limits. Because these "conditions" are not germane to Sebago, it is unlikely that a stocking rate of 0.3 fish per acre (10,000 spring yearlings) can be sustained on Sebago Lake, particularly if size quality objectives are to be met. A salmon "stocking rate" (hatchery + wild) of 0.2 spring yearling salmon per surface acre (~6,000 spring yearlings) will even be difficult to attain with the current level of lake trout production. Hatchery stocking that occurred in 2007 (2,500 spring yearlings) represents a stocking rate of 0.08 spring yearling salmon per surface acre, which does not include wild salmon production. Wild salmon contributions from the Crooked River appear to be comparable, for a combined effective stocking rate of 0.16 fish per acre (~5,000 sublegal salmon).

Expressed angler interest in enhancing the proportion of wild salmon in the lake fishery appears to be inconsistent with their desire to increase salmon stocking and enhancing salmon size quality. This inconsistency partially reflects angler desire for higher salmon catch rates associated with the lake fishery. Wild salmon production and recruitment to the lake fishery can be variable from year to year, and in the past the Department was not been able to quantify wild salmon production to assess the need for hatchery stocking. The Department now has a habitat based model to estimate wild salmon

contribution, and hopefully this will instill confidence in the angling community that lake habitat is being fully utilized. Public perception, particularly because of past stocking practices, and limited wild salmon production in the Crooked River favors a greater emphasis on hatchery stocking. However, management will focus on the enhancement of wild salmon stocks as the primary source to sustain the lake fishery, augmented with hatchery salmon as needed to achieve catch and size quality objectives, while striving to utilize available lake habitat. This approach will increase the availability of wild salmon desired by lake and river anglers, reduce MDIFW hatchery stocking costs, and provide flexibility to stock hatchery salmon as needed to utilize available habitat, while achieving growth and catch rate objectives.

8) *Additional Considerations* Stocking hatchery salmon has been a main stay on Sebago since 1907, because until recently, dams limited the production of wild salmon in the Crooked River, and the historical carrying capacity of the lake exceeded available wild salmon production and recruitment. Wild salmon production on the Crooked River was severely limited for over 150 years. In fact, wild salmon did not have access to 66% of the spawning and nursery habitat in the Crooked River until the 1970's, when the partial removal of Scribner's Mill dam provided salmon access to an additional 4 miles of upstream habitat. A fishway was installed soon after at the next upstream dam (Bolster's Mill) Dam that operated from the mid 1970's through the mid 1980's. However, unfettered upstream access was not fully established until the Bolster's Dam was partially removed in 1988. Future lake stocking of hatchery salmon should more carefully consider the significant potential increase in wild salmon production from the Crooked River. The ability for the wild population to sustain Sebago's salmon fishery has not been subject of recent formal evaluation, although anecdotal reports of the 2007 fishing season indicates the fishing for salmon was some of the best (quality + quantity) experienced in the last five or 6 decades, and 70% of this fishery was comprised of wild salmon. Wild salmon production in the Crooked River is expected to continue to increase, however, a long history of stocking have created a public expectation that Sebago will be well stocked annually with hatchery salmon. Furthermore, numerous past studies, involving various age classes of salmon resulted in the perception that high stocking rates were needed to maintain a quality salmon fishery, however, these elevated stocking rates were maintained prior to restoring spawning access to the Crooked River and prior to the lake trout population exceeding the lake's carrying capacity. Changes in Lake trout and wild salmon abundance must be considered to successfully develop and maintain a quality salmon fishery.

Conclusion This plan attempts to balance a diversity of perceived public interests, concerns, and expectations, while ensuring continued protection to and enhancement of the indigenous population of wild salmon that inhabits Sebago Lake. The plan provides guidance that will favor attainment of size quality objectives under the Classic Salmon designation, while being considerate of angler catch rate expectations. Because the plan attempts to balance biological and social issues, it is likely no one group or segment of the angling community will be fully satisfied with the approach developed in this plan.

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