

2006 New York Cooperative Trout and Salmon Pen-Rearing Projects

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In 1998, concerns over post-stocking survival and imprinting of steelhead and Chinook salmon to stocking sites led to the formation of several cooperative sportsmen's groups interested in pen rearing (Bishop and Pearsall 1999). Concerns from the eastern basin of Lake Ontario centered on the predation of stocked steelhead by cormorants. Western basin concerns included the apparent lack of imprinting and subsequent impaired homing of Chinook salmon and steelhead to the stocking streams.

After the successful completion of pen-rearing projects at Oswego Harbor and Oak Orchard Creek in 1998, a number of other sportsmen's groups expressed interest in pen-rearing. New sites were added in 1999, including the Lower Niagara River, Sandy Creek, Genesee River and Sodus Bay. No additional sites were added until 2003, when a new pen project for Skamania steelhead was initiated at Little Salmon River. In 2005, a Chinook pen-rearing project was initiated at Olcott Harbor on Eighteenmile Creek and steelhead were added here in 2006. Also in 2006, a steelhead pen-rearing project was initiated at Wilson Harbor and only steelhead were raised at the Lower Niagara and Sandy Creek pen-rearing projects. All sites have been active each year since inception, except for Sandy Creek which was inactive in 2004 and 2005.

Evaluations of the pen-rearing studies conducted at Oak Orchard Creek and the Lower Niagara River are reported in Bishop et al. (2006). This report summarizes 2006 pen-rearing activities and results.

Methods

All sites, except the Lower Niagara River, used similar pen materials, design and netting as described for the 1998 Oak Orchard Creek Project in Bishop and Pearsall (1999). Standard operating procedures for stocking, maintaining, feeding, and releasing penned salmon were developed and refined by NYSDEC (Wilkinson 1999, Sanderson 2006). Differences are noted under each specific site description. Table 1 provides characteristics of each of the pen-rearing sites.

Observed mortalities for all projects were based on the number of dead fish collected from the pens during captivity and from the bottom of the pens after release. Both sources of mortality were noted by cooperators, except where listed otherwise. Mortality does not include fish lost to cannibalism or from predators that may have gained access to pens.

Little Salmon River

Five-thousand Skamania steelhead were placed into three pens at Salmon Country Marina on 18

April by the Little Salmon River group. The steelhead were administered a double fin clip (adipose and left pectoral fin); the standard clip for all New York stocked Lake Ontario Skamania steelhead.

Penned steelhead were fed five times daily, and pens were cleaned twice during the rearing period. Water temperature was measured once each day. On 9 May, after 21 days of rearing, the pen was towed to the mouth of the Little Salmon River where the steelhead were released.

Oswego Harbor

Twenty-thousand steelhead were placed by the Oswego Net Pen Group into three pens at Oswego Marina on the Oswego River on 14 April. Forty-thousand Chinook were also placed into two pens on the same date.

Penned steelhead and Chinook were generally fed five times daily, although on some days, the fish were fed as infrequently as three times per day. Water temperature was recorded at most feedings. Pen netting cleaning times were not recorded during the pen rearing period. Steelhead were released on 5 May (22 days in pens) and salmon were released on 8 May (25 days in pens) by releasing them at the pen site. Both species were released without towing to the Lake, as had been done in previous years.

Sodus Bay

On 12 April, 52,600 Chinook were placed into two pens near First Creek at Sodus Bay. Chinook were piped to the pens directly from the hatchery truck.

Feeding was performed five times per day, and pens were cleaned weekly during the rearing period. Water temperature was monitored with a digital recording device starting on 12 April. Dissolved oxygen was measured on 1 May with a YSI Model 55 meter. On 6 May, after 25 days of rearing, the pens were towed into the open lake. The fish were released in approximately 25 feet of water lakeward, and east of Sodus Bay Channel. Pens were inverted to release the fish.

Genesee River

The Genesee Charter Association, in conjunction with Irondequoit Bay Fish and Game Club and Greater Rochester Sportfishery Association, used six pens located at Shumway Marina in the Genesee River for raising steelhead and Chinook. Ten-thousand steelhead were placed into two pens on 11 April. Chinook (85,250) were placed in four pens also on 11 April. The pens were gravity-loaded by piping the steelhead and salmon from the hatchery truck.

Feeding was performed five times per day, and pens were cleaned once weekly. Water temperature was monitored with a digital recorder starting on 11 April. Dissolved oxygen was measured on 28 April with a YSI Model 55 meter. Steelhead and Chinook were released on 29 April and 3 May, respectively, by inverting the pens on site. Chinook were released four days after the steelhead to reduce potential predation by steelhead upon recently-stocked Chinook.

Sandy Creek

The Sandy Creek project was a community group effort. Volunteers included SUNY Brockport students, Boy Scouts, high school groups, charter captains, and community members. On 14 April, 7,300 steelhead were placed into two pens in the Sandy Creek Marina basin. The steelhead were piped to the pens directly from the hatchery truck. The pens were then towed from the basin to the creek immediately adjacent to the marina, and tied to a private residence dock. The pens were oriented with their long axis parallel to water flow.

Feeding was performed six times per day, and pens were cleaned once a day during the rearing period. Water temperature was monitored with a digital recording device starting on 14 April. Dissolved oxygen was measured on 24 and 28 April with a YSI Model 55 meter. On 29 April, after 16 days of rearing, the pens were inverted to release the fish at the pen site.

Oak Orchard Creek

The Oak Orchard Business Association sponsored

this pen project. On 10 April, 14,000 steelhead were delivered to Lake Breeze Marina and placed into three pens. On the same date, 85,250 Chinook were placed into four pens at the same location. A PVC extension pipe was used to transfer steelhead and Chinook into pens located farthest from the shore.

Trout and salmon were fed four times daily, and pens were cleaned every two days. Water temperature was monitored with a digital recording device starting on 10 April. Dissolved oxygen was measured on 24 April with a YSI Model 55 meter. The steelhead and salmon were released after 17 days on 26 April by towing the pens to the river mouth at Point Breeze.

Eighteenmile Creek

The Eighteenmile Creek pen project was sponsored by the Lake Ontario Trout and Salmon Association (LOTSAs), Town of Newfane, Niagara County Fisheries Development Board, Niagara County "Skip Hartman" Pro-Am Tournament and Slippery Sinker Bait and Tackle. The pen site was located in Olcott Harbor at the Town of Newfane Marina and at a private dock located just north of the town marina. The project was expanded in 2006, its second year, to include steelhead. Steelhead were kept in one pen at the marina, and Chinook salmon were kept in two pens at the private dock. The pens were tethered to pile-supported docks and oriented with their long axis parallel to water flow.

Fifty-thousand Chinook salmon and 3,500 steelhead were placed into pens on 13 April. Fish were piped directly from the hatchery truck to the pens. Fish were fed five times daily, and water temperature was monitored continuously with a digital thermometer. Temperature was recorded by volunteers at each feeding. Pens were brushed every three days during the penning period to remove algae and silt.

Fish growth was monitored three times, twice at approximately one-week intervals subsequent to stocking, and once just prior to release of the fish. Dissolved oxygen was measured twice, on 28

April and 3 May, in each pen and outside pens during mid-day using a YSI model 55 meter. Measurements were taken at three depths at each sampling location: subsurface, 2 ft. and 4 ft. On 30 April, steelhead were released from pen #1, and on 4 May, Chinook salmon were released from pens #2 and #3. Pens were not towed or moved prior to releasing fish. The fish were released by cutting netting ties and attaching weights to the netting, thus allowing netting to slip downward. Most trout and salmon left the nets soon after the netting was opened, however the pens were given a final sweep with a net to drive out any residual trout or salmon.

Wilson Harbor

The Wilson Harbor pen project, located along the East Branch of Twelvemile Creek in Niagara County, was initiated in 2006. The project was sponsored by the Town of Wilson and the Rotary Club of Central Niagara County. Two pens, both previously used at the Lower Niagara River pen site, were used to rear steelhead. The pens were located at Sunset Bay Marina, approximately one-half mile upstream from the harbor mouth. The pens were tethered to pile-supported docks, and water depth at the site was sufficient to keep both pens from contacting the creek bottom.

Five thousand steelhead were placed into the two pens on 19 April. Fish were piped directly from the hatchery truck to pens. Fish were fed five times each day. Water temperature was continuously monitored with a digital thermometer, and temperature was recorded by volunteers at feeding times. Pens were brushed every two days until the fish were released.

Dissolved oxygen was measured in each pen and at a nearby location outside the pens twice during the 22-day penning period using a YSI Model 55 meter. Three measurements were taken at each sampling location: subsurface, 2 ft. and 4 ft. depths. Steelhead were released on 11 May. One pound weights were attached to netting at 6 locations on each pen and the cable ties were cut. The netting was then lowered, allowing fish to freely swim from the pen. Naturally low water

transparency at the site made it difficult to observe the rate at which fish left the pens.

Lower Niagara River

The Niagara River Anglers Association (NRAA) pen site has been located in a boat slip on the Lower Niagara River at Constitution Park in the Village of Youngstown since 2004. The pen site is located approximately one mile upstream from the confluence of the Lower Niagara River and Lake Ontario.

Twenty-thousand steelhead were placed into two pens, located immediately adjacent to one another in the boat slip on 4 May. The fish were piped directly into the pens from the stocking truck. River water temperature was approximately 48°F at time of stocking.

Steelhead were fed five times daily, and pen water temperature was monitored continuously with a digital meter. Water temperature was recorded at each feeding. Pen netting was cleaned on several occasions by power washing the portion of the netting near the water surface. Steelhead were weighed twice during the 22-day penning period, once approximately 13 days after stocking and a second time on the final day of the project. Dissolved oxygen was measured on 19 and 25 May using a YSI Model 55 meter at three locations in each pen during mid-day. Measurements were also made at two locations in the river approximately 2-4 ft. water ward of the pens, just upstream and downstream of the pens. Four measurements were taken at each sampling location: subsurface, 2ft., 4ft. and 6ft. depths.

Steelhead were released on 26 May by lowering the netting at the rearing site.

Results and Discussion

A total of 84,800 steelhead (Washington and Skamania strains) were raised at eight pen sites, comprising 13.1% of NYSDEC's Lake Ontario rainbow trout/steelhead stocking allotment in 2006. Observed mortalities at the five steelhead rearing sites ranged from 0.068 to 0.5% (Table 1).

Overall, steelhead mortality in 2006 was low compared with previous years. Five pen-rearing sites raised a total of 313,100 Chinook salmon, representing 18% of NYSDEC's 2006 Chinook salmon stocking allotment. At the five sites where Chinook were penned, mortality estimates ranged from 0.074 to 0.19%.

Water temperatures during the pen-rearing period generally benefited from cool weather during late April and early May. The water temperature criterion (65°F) established for pen projects was not exceeded at any pen rearing site.

Little Salmon River

In the fourth year of pen-rearing at Little Salmon River, Skamania steelhead grew from 14.7 to 9.4 fish per lb after 21 days in the pen (Table 1). Due to their relatively large size at delivery to the pen, the Skamania yearlings may not have received the full benefit of imprinting to the project site.

Water temperatures ranged from 48 to 61 degrees F. Seagulls were noted as a problem during the release from the pens.

Oswego Harbor

Steelhead were delivered at 16 per pound. When released on 5 May, they weighed 7.5 fish per lb. Chinook grew from 130 fish per lb to 52.3 fish per lb after 25 days. During both the steelhead and Chinook rearing period, the water temperature stayed within guidelines, ranging from 46 to 55 degrees F.

Sodus Bay

Chinook grew from 120 fish per lb to 89 fish per lb (mean weight of two samples, one from each pen) after 25 days. The mean total length of a 20 fish sample of the released Chinook was 87 mm (3.4 in).

Water temperatures measured by the recording thermometer ranged from 48-62° F. During release, the Bay temperature was 52° F and the Lake temperature was 47° F. On 1 May, Dissolved oxygen (DO) at the pen site was measured at 9.8 mg/L.

Genesee River

Steelhead were released on 29 April and weighed 13 fish per lb (mean weight of two samples, one from each pen), compared to a delivery weight of 16 fish per lb. The mean total length of a 20 fish sample of the released steelhead was 164 mm (6.5 in). Chinook released from pens on 5 May weighed 86 fish per lb (mean weight of four samples, one from each pen), versus a delivery weight of 110 fish per lb. The mean total length of a 40 fish sample of the released Chinook was 86 mm (3.4 in).

Water temperatures measured by the recording thermometer ranged from 48-60° F during the period that both species were in pens. The temperature of the Genesee River at the time of steelhead release was 56° F. On 28 April, DO at the pen site was measured at 10.4 mg/L.

Sandy Creek

Steelhead were delivered at 16 per pound. They were held in the pens for 16 days and released on 29 April. The average of two samples (one from each pen) was 12.3 fish per pound. The average of twenty steelhead was 166.8 mm (6.6 in).

Water temperatures measured by the recording thermometer ranged from 49-63° F, well within the guidelines and due, to the cool spring, cooler than this site had been in the past. The temperature of the creek at the time of steelhead release was 56° F. On 28 April, DO at the pen site was measured at 8.0 mg/L.

Oak Orchard Creek

Steelhead were held in pens from 10 April to 26 April, a total of 17 days. Two samples of steelhead, one from each pen, weighed 11.3 fish per lb and were 161 mm (6.3 in) total length when released. Chinook were also held for 17 days and released, weighing 86 fish per lb (mean of 4 samples, one from each pen). Mean total length of a forty fish sample was 84.5 mm (3.3 in).

Water temperatures measured by the recording thermometer ranged from 49-64° F during the period that both species were in pens. The

temperature of the Oak Orchard River release site at the time of release was 55° F. On 24 April, DO at the pen site was measured at 8.2 mg/L.

Eighteenmile Creek

Steelhead were released on 30 April after 17 days in the pen. Initial weight of steelhead was 18 fish per lb., and final weight was 11.4 fish per lb. Chinook were released on 4 May after 21 days in pens. Initial weight of chinooks was 120 fish per lb. Chinook weight, measured one day prior to release, was 53.2 fish per lb. in one pen and 64.4 fish per lb. in the second pen. Water temperatures on release dates were 57.9 and 61.1°F, respectively, for steelhead and Chinook.

DO values measured on 28 April ranged from 9.1 to 9.2 ppm in the steelhead pen and from 8.4 to 9.0 ppm in the two chinook pens. Values outside the pens ranged from 9.1 to 9.3 ppm. DO values on 3 May ranged from 10.5 to 11.2 ppm in the Chinook pens, while values outside the pens ranged from 10.8 to 11.0 ppm. All the measured values were much greater than the 5 ppm DO criterion established for pen projects (Wilkinson 1999).

Wilson Harbor

Steelhead were released on 11 May, after 22 days in the pens. Initial steelhead weight was 19 fish per lb., and mean weight of samples from both pens on the release date was 11.7 fish per lb.

DO values measured on 28 April ranged from 9.9 to 10.2 ppm in the two pens. DO values measured outside the pens ranged from 9.7 to 9.8 ppm. DO values measured on 3 May ranged from 9.3 to 10.3 ppm in the pens, and values outside the pens ranged from 9.6 to 9.8 ppm. All DO values measured were substantially higher than the 5 ppm critical criteria established for Lake Ontario pen projects (Wilkinson 1999).

Lower Niagara River

Steelhead were penned for 22 days and released on 26 May. At release, sample weights of fish taken from each pen were both 12.0 fish per lb. Although lengths were not measured, the

steelhead appeared to be much more consistent in length than in previous years. Water temperature in the pens was approximately 53°F on the release date.

DO values measured on 19 May in pens ranged from 9.7 to 11.6 ppm. DO values in the Niagara River in close proximity to the pens ranged from 11.4 to 11.8 ppm. DO values measured on 25 May in pens ranged from 9.2 to 10.8 ppm. DO values in the Niagara River in close proximity to the pens ranged from 11.2 to 12.0 ppm. On both dates, DO was slightly higher in the river than in the pens, despite the presence of the water circulation/aeration pumping system.

Conclusions

Steelhead target weights (12-15 fish per lb) were reached at all of the eight pen sites. Chinook target weights (90 fish per lb) were achieved at all five of the pen sites, as well. It is likely that a large percentage of the penned fish imprinted to water at their respective pen sites, since a large majority of fish reached target weights.

The ninth year of pen-rearing steelhead and chinook salmon along the New York shoreline of Lake Ontario was very successful due to relatively low fish mortality at most sites, a relatively high percentage of fish reaching target weights, and the goodwill generated through growing partnerships in the projects.

Acknowledgments

We wish to express our sincere appreciation to the many individuals, businesses, and organizations that made these projects possible. Their dedicated efforts demonstrated a deep commitment to the resource and provided a new management technique that would not have been available without their help.

References

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Table 1. Characteristics of 2006 Lake Ontario trout and salmon pen-rearing projects.

Site	Species (Strain)	Number Stocked	Number of pens	Date Stocked	Size at Stocking (#/Lb)	Date Released (Days Held)	Size at Release (#/Lb)	Temp. Range (°F)	Mortality (# Fish)	Mortality (%)
Little Salmon	steelhead (Skamania)	5,000	3	18 April	14.7	9 May (21)	9.4	48-61	9	0.18
Oswego	steelhead	20,000	3	14 April	16	5 May (22)	7.5	46-55	<50	<0.25
Oswego	Chinook	40,000	2	14 April	130	8 May (25)	52.3	46-55	<50	<0.13
Sodus	Chinook	52,600	2	12 April	120	6 May (25)	89.0	48-62a	99	0.19
Genesee	steelhead	10,000	2	11 April	18	29 April (19)	13.3	48-60a	15	0.15
Genesee	Chinook	85,250	4	11 April	110	3 May (23)	85.7	48-60a	67	0.079
Sandy	steelhead	7,300	2	14 April	16	29 April (16)	12.3	49-63a	5	0.068
Oak Orchard	steelhead	14,000	3	10 April	18	26 April (17)	11.3	49-64a	70	0.50
Oak Orchard	Chinook	85,250	4	10 April	110	26 April (17)	86.0	49-64a	165	0.19
Wilson	steelhead	5,000	2	19 April	19	11 May (22)	11.7	51-63	13	0.26
Eighteen-mile	steelhead	3,500	1	13 April	18	30 Apr. (17)	11.4	52-60	0	0
Eighteen-mile	Chinook	50,000	2	13 April	120	4 May (21)	58.8	52-61	37	0.074
Niagara	steelhead	20,000	2	4 May	19.9	26 May (22)	12.0	48-53	25	0.13

Notes:

- a Temperature was monitored with a recorder for duration.