Options for optimizing growth and catch rates for kokanee fisheries in Connecticut

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Last update 1/28/2021

Background:

Connecticut anglers have the unique opportunity to target Kokanee as we are the only state east of the Mississippi River other than North Carolina that has Kokanee fisheries. Angler survey data from West Hill Pond (2014) showed Kokanee fishing generated 28% of the total angler effort (20,324 total annual angler hours), equating to 5,690 angler hours per year in West Hill Pond alone. Survey data collected in 2011 from East Twin Lake showed much less angler effort (733 angler hours) toward Kokanee, but the fishery had just begun to rebound in 2008 and had not yet fully developed. Using the West Hill angler survey data as a barometer, Kokanee fishing in Connecticut currently generates between 8,000 – 12,000 angler hours per year.

Attempts have been made to start additional Kokanee fisheries in 18 lakes throughout CT (Appendix 1), but none have been successful, suggesting that most of Connecticut's waters do not have the biological, chemical, and/or physical parameters necessary for Kokanee survival and growth. Kokanee fisheries in Connecticut rely completely on spring stocking small fingerlings (2.5" – 3") reared from broodstock captured the previous fall in one of two kokanee management lakes.

At present, West Hill Pond and East Twin Lake encompass CT's entire Kokanee management program. A third lake (Beach Pond), has been stocked with Kokanee fry since 2016 in attempts to restore a unique salmon fishery in eastern CT (note – Beach Pond once had a limited fishery during the late 60's through mid-1970's). Beach Pond will be evaluated via fall trap netting in 2020 to determine if the fry stocking has been successful. Lake Wononscopomuc was once a Kokanee management lake, but the salmon population disappeared with the presence of Alewives (first detected in 1995) which currently remain abundant in the lake. Alewives (first detected in 1989; Table 2) also caused the complete collapse of our most popular salmon fishery in East Twin Lake between the years 1995 – 2007. However, and conversely to Wononskopomuc, the Alewives completely disappeared in East Twin, likely due to a combination of factors: 1) environmental conditions (e.g., super-cooling of the water column during periods of open water in the winter), and 2) competition for food from Zebra mussels. The combination of these factors along with predation from trout and other resident fish allowed Kokanee management to resume in 2008.

While adult Kokanee have been observed spawning in East Twin, Wononskopomuc and West Hill Pond, recently no natural reproduction has ever been documented in our lakes. However, recent reports of young Kokanee being caught in Wononskopomuc may indicate some level of natural reproduction is occurring, but this needs to be investigated further. Early records from East Twin Lake indicate that when Kokanee were first stocked in the 1930's a small fishery did develop during the 40's, indicating that natural reproduction must have occurred at some level. While a fishery did develop, natural reproduction could not sustain the fishery and eggs were brought into CT from Colorado in 1959. Since that time, CT biologists have relied on CT fish for broodstock and have only re-introduced Colorado

genetics in 1982, 1998 and again in 2004 (Appendix 2) when CT lakes fell short in providing adequate numbers of broodstock, and consequently not enough eggs to perpetuate the management program.

Because natural reproduction cannot sustain fisheries in CT, ensuring a consistent source of broodstock in our management lakes is critical to the program's future. Of equal importance to maintaining a consistent source of broodstock, is providing stable catch rates to anglers fishing for these unique fish.

Challenges to Kokanaee Management:

In Connecticut, the biggest challenge to Kokanee management is inter-specific competition for zooplankton by another limnetic planktivore, the Alewife. Since Kokanee management began in CT, the state has lost two of its once thriving fisheries due to Alewives. The collapse of Kokanee fisheries due to inter-specific competition is not unique to CT and has occurred in other regions of the country (Frank Frost – retired State of Maine District Bio, and Tom Pentigale, District Biologist, Utah, personal communication). Likewise, intra-specific competition can play a role in growth of Kokanee, but this threat can be overcome by altering stocking numbers to achieve a balance between angler catch rates and size of adult salmon.

Alewives: There was a strong and clear relationship between the presence of Alewives and the reduction in size, egg production and survival of Kokanee in East Twin Lake and Lake Wononscopomuc ([1]Machowski et al., 2005). Kokanee and Alewives are competitors, since both feed exclusively on zooplankton.

Other competitors:

Rainbow Trout - Data obtained from West Hill Pond (1992 – 2010) indicated an inverse relationship between the number of Rainbow Trout stocked and the size of mature Kokanee (Figure 1). Like Kokanee, Rainbow Trout feed on zooplankton. To increase the size of Kokanee, Rainbow Trout stocking was greatly reduced from an annual high of close to 20,000 (early 1990's) to an annual average of 3,000 from 1999 through 2010. With the reduction of Rainbow Trout stocking in West Hill Pond, kokanee size increased. Based on these data, the Fisheries Division also reduced the number of Rainbow Trout stocked into East Twin Lake.

[1] Machowski E. A., G. H. Leonard, and R. A. Orciari. 2005. Inland Fisheries Research and Management, Coldwater Fisheries Management, Kokanee Management. Connecticut Department of Environmental Protection. Federal Aid to Sport Fish Restoration. Final Report F-57-R-23. Harwinton.

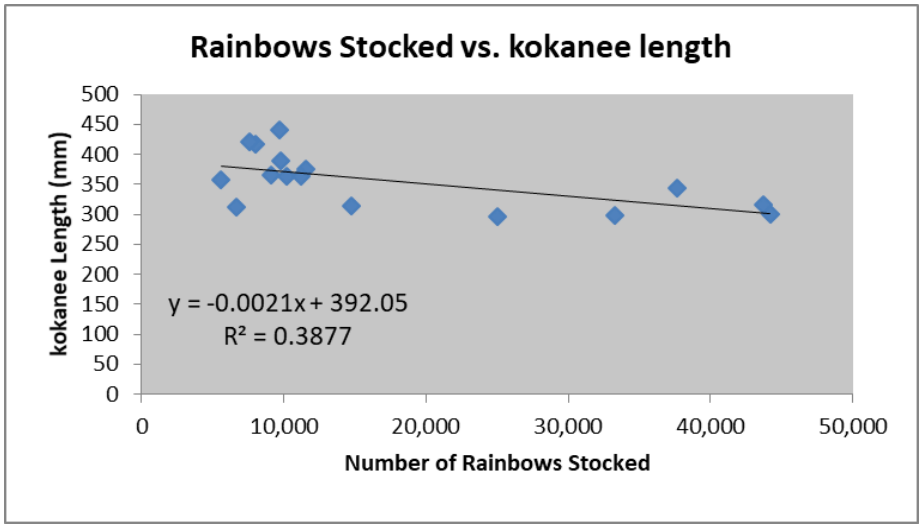

Figure 1 – Comparison of the average length of each year class of mature Kokanee collected in the fall, 1994-2004 versus the total number of Rainbow Trout that were stocked during the 3-year life span of each year class of Kokanee in West Hill Pond.

Zebra mussels - were first detected in 1998 in East Twin Lake, and routine dive investigations showed zebra mussels to be abundant. Zebra mussel monitoring has not been performed since 2007, but visual observation of adult mussels attached to hard surfaces within the lake's littoral zone confirms they are still present in East Twin Lake, and although their abundance is currently unknown, could possibly impact growth of Kokanee by filtering large quantities phytoplankton thus reducing the food necessary for zooplankton production.

Zooplankton tows were not performed in East Twin Lake to determine the effects of Zebra mussels on the lake's zooplankton community. However, using secchi disc readings taken during the summer as a proxy for plankton tows, show similar transparency readings before Zebra mussels were detected (1984 -1998; average secchi disc = 4.77 meters; range = 2.5 – 10.9 meters) versus (1999 – present; average secchi disc = 4.87 meters; range = 3 – 6.5 meters).

Genetics: CT has relied on a breeding index called the "effective breeding number." Essentially, if the number of females used for broodstock falls below 100, inbreeding depression could occur. Current State hatchery supervisor (Tom Chairvolotte) has set an annual goal of 225 male/female breeding pairs to maintain genetic integrity. It should be noted that the historic loss of Kokanee in CT lakes was not due to an inherent genetic issue (e.g., loss of vigor or fecundity), but due strictly to competition for food, and in each case Alewives were the root cause. That said, inbreeding depression in any small, isolated population is possible and signs of this in CT's Kokanee populations need to be monitored and corrected as necessary.

It is worth noting the Kokanee in CT that originated from CO stem from a very specific genetic line - the Roaring Judy strain. The Roaring Judy strain of Kokanee typically spawn later (October) and the coloration of the spawning adults tends to be a much darker red, almost blackish/red when fully mature. The Roaring Judy strain is also more of a lake-spawning salmon and does not require a river or stream to complete spawning.

Water quality: Annual temperature/dissolved oxygen (DO) profiles conducted in our Kokanee lakes indicate that there is no physical or chemical evidence to suggest a significant change in water quality in these waterbodies. Both active management lakes have very small watersheds, from which nutrient loading would be slight. Eutrophication occurs slowly, especially in lakes with small watersheds.

Current Management Challenges:

Each of CT's kokanee lakes have very different and distinct challenges for kokanee management. Both East Twin Lake and West Hill Pond have excellent summer habitat ($\leq$19^{o}C, with $\geq$4mg/l of DO) for salmonids with ample volumes of cold, well oxygenated water. However, the two lakes differ greatly in productivity. East Twin Lake is highly productive due to the underlying bed of limestone, and conversely, West Hill Pond, sitting atop a granite-based hill, is low in nutrients necessary to drive zooplankton production.

West Hill Pond

Growth of Kokanee has varied slightly year-to-year, but overall has remained fairly consistent (2010 – 2019 avg. TL = 392mm; Range = 333mm – 473mm; Appendix 2). The issue that plagues West Hill Pond are the large fluctuations in Kokanee abundance for unknown reasons. During years where the density of Kokanee in West Hill Pond are low, growth in those years is typically excellent. For example, from 2010 -2013 when fall netting efforts provided more than adequate numbers of broodstock average total length was 344mm, whereas the following three years when netting efforts struggled to provide the target numbers of broodstock, average total length was 456mm, suggesting density dependent growth.

Despite the lakes long track record of providing broodstock, the lake's Kokanee numbers continue to be highly variable. Even with very consistent stocking, adult Kokanee numbers seem to cycle every 4-5 years. Four to five years of robust numbers followed by 1-2 years of low adult abundance. The exact reason for this variability is unknown, but poor juvenile survival due to food limitations at time of stocking is suspected. Young salmon fry do not have much in the way of body reserves to keep them going when food supply wanes, so ample zooplankton needs to be available at time of stocking. It is also possible that heavy predation could result in poor fry survival. However, nighttime electrofishing data has shown no substantial increase in the lake's predatory fish. As a fish management response to these fluctuations in abundance, in 2004 the Fisheries Division decided to split the stockings where half the fish were stocked in mid-May and the other half stocked in early June. This was done to allow the lake's zooplankton abundance to increase with warming water temperatures and increase the likelihood that sufficient food would be available for the newly stocked fry. Since adopting this strategy, the fluctuations in adult Kokanee numbers have been less severe, but continue to be a management concern.

East Twin Lake

Unlike West Hill Pond, Kokanee survival in East Twin is typically excellent due in large part to the abundant zooplankton food source. The current issue at East Twin is the small size of the Kokanee. Anecdotal reports from Kokanee anglers indicate that catch rates are excellent, but average size is approximately 10 inches (250mm) with very few fish exceeding 12 inches (305mm). Target summer average length should be 12-15 inches (305-380mm), and East Twin is falling well short of that. This is the 3rd consecutive year of small Kokanee.

Some possible reasons for the small size Kokanee are: a competitor species (Alewife) is once again present in the lake resulting in decreased growth; number of Kokanee in the lake is too high resulting in intraspecific competition, and/or Zebra mussels are possibly impacting growth. It should be noted that the last Zebra mussel investigation at East Twin (2007) indicated that the Zebra mussel population had actually declined slightly from past counts. In addition, Zebra mussels tend to affect cladoceran communities from the bottom-up by filtering primarily phytoplankton, Rotifers and Nauplii ([2]Feniova, et al., 2015). Larger bodied Daphnia, the main food source for kokanee, are seldom removed from the water column by zebra mussels but it's possible that removal of phytoplankton by the mussels could negatively affect Daphnia abundance.

Beginning in 2013, stocking numbers for East Twin Lake were increased (Appendix 2) in attempts to increase catch rates and to use surplus fry at the hatchery. However, while catch rates for Kokanee did greatly improve, by 2017/18 average size began to decline. Assuming intraspecific competition had resulted in the decreased size, the Fisheries Division dropped the annual stocking number to 70,000 fry in spring of 2018. To date, the reduced stocking number has not helped increase the size of kokanee at East Twin.

Suggested Options to improve Kokanee numbers and size:

West Hill Pond

While abundance of kokanee can fluctuate from year to year, growth of Kokanee in West Hill appears stable and fairly consistent based on length data collected from broodstock. As such, there is no need to adjust stocking numbers at this point in time. However, the issue of periodic poor year class strength suggests that timing of stocking may be most important in West Hill Pond:

1) Determine age and growth rate to compare against Kokanee from East Twin Lake. The target goal is 50-100 individuals.
2) Refine current stocking practices (half stocked in May and half stocked in June) by marking the larger June-stocked fish via an adipose clip over a three year period, beginning in 2021. While time consuming, this will help identify if the June-stocked fry consistently outperform the May-stocked fish. If so, it may be possible to move entirely to stocking in June to reduce fluctuations in abundance.
3) Identify zooplankton species composition and peak abundance to refine stocking timing if necessary.
    - Contact Northeast Aquatic Research (NEAR) who is the consultant hired by the West Hill Pond Association to monitor water quality, to see if they have collected zooplankton data as part of their monitoring efforts. These data could help refine our stocking without having to collect additional data.

[2] Feniova, I., P. Dawidowicz, M. I. Gladyshev, I. Kostrzewska-Szlakowska, M. Rzepecki, V. Razlutskij, N. N. Sushchik, N. Majsak, A. R. Dzialowski. 2015. Experimental effects of large-bodied Daphnia, fish and zebra mussels on cladoceran community and size structure. Journal of Plankton Research, Vol 37, Issue 3. PP. 611-625. https://www.researchgate.net/publication/275227353_Experimental_effects_of_large-bodied_Daphnia_fish_and_zebra_mussels_on_cladoceran_community_and_size_structure

If NEAR does not have the necessary data and marking of June-stocked fish has not helped to improve year class strength:

- Perform plankton tows weekly May and June (beginning 2021 and continuing for several years).
- Determine the optimal density of zooplankton based on the zooplankton data collected and identify potential date range for stocking.

If this does not eliminate or at least reduce fluctuations in year class strength:

- Perform weekly plankton tows beginning in May of each year to identify when zooplankton abundance is within the optimal range for stocking Kokanee fry. This is time consuming and there is the risk that in any given year, zooplankton abundance never reaches optimal density. In which case Kokanee would be held at the Burlington Hatchery tying up hatchery space, personnel time and increased feed costs.

<u>East Twin Lake</u>

Currently, catch rates for anglers fishing and targeting Kokanee in East Twin Lake during the spring/early summer of 2020 are very high (5+ kokanee per hour; Quiet Water Charters, personal communication), suggesting that survival of stocked Kokanee is excellent. To address the issue of fish size:

1) Collect scale samples from Kokanee in East Twin beginning in summer 2020 to determine age of the fish and compare growth against fish from West Hill Pond. Target number is between 50 – 100 individual samples.
2) If growth is poor and they aren't just young Kokanee:
    - Set vertical nets late summer (August) 2020 to determine presence/absence of Alewives.
    - Reduce stocking numbers to 50,000 in 2021 and continue to monitor size.

Other Considerations:

1. With only two management lakes (Beach Pond is still in the experimental phase) maintaining a source of broodstock is essential. A couple options include:
    - Start a hatchery based broodstock program. This had been discussed at length in the past, but may not be a viable option. It would tie up a tremendous amount of hatchery space and personnel time because multiple year classes would need to be maintained.
    - Find a suitable "non-fished" water supply reservoir and stock it annually with Kokanee fry. If we could find a reservoir that could support Kokanee (e.g., Lake Gallaird, Barkhamsted Reservoir), we could maintain the population through annual stocking and only net out the spawning adults if our other management lakes fall short in providing broodstock.
2. Data from Colorado, where their best Kokanee lake is one that is only stocked with progeny from adults captured in that waterbody, suggests that Kokanee, over time, may become genetically suited to a specific water body. As long as CT can continually meet the required number of breeding pairs (225 male/female pairs) then genetic depression should not be an issue. If, however, the minimum number of breeding pairs cannot be acquired, one option

would be to use creative crossing techniques to maintain the genetic integrity of the population. As a last resort, genetic infusion from a completely disease free source may be necessary to maintain this unique fishing opportunity.

3. Find a certified disease free source of Kokanee eggs to use as a backup plan (see previous consideration) should our management lakes fail to produce adequate numbers of spawning adults. This same source could be used as a way to introduce new genetic material into our population(s) should our fish begin to show signs of genetic bottlenecking (e.g., poor growth not due to competition or density related factors).
4. Continue to entertain the idea of finding a suitable lake to start a new fishery, especially if Beach Pond fails to produce adult fish. Attempts at stocking numerous lakes (Appendix 1) have been tried over the years, most all of which have failed. However, places like Colebrook Reservoir was only stocked for 2 years and no monitoring data was ever recorded, so we assume the biologists in the 1960's were basing success or failure on anecdotal fishermen reports.

Work performed in 2020 (updated 1/7/21):

Beach Pond Assessment:

Beach Pond has been stocked with varying numbers of Kokanee fingerlings annually since 2016. To evaluate these stockings, three trap nets were set in the lake in the fall 2020. Nets were set 10/5/20 and fished through 10/9/20 for a total of 12 net-days. Nets were tended on both 10/7 and when they were pulled on 10/9.

A total of 16 mature adult salmon were captured (1.3 Kokanee/net-day) with an average total length of 377mm.

These findings are encouraging and suggest that a low-level population exists in Beach Pond. Stocking numbers for the first 2 years were low and only fingerlings that were surplus to the needs for other management lakes. However, beginning in 2019 Beach Pond has been stocked with a full allotment of 50,000 fingerlings. A full assessment will be done in the future once we have 3-4 years of full stocking allotments.

Interspecific Competition:

To address concerns that Alewives may have returned to East Twin Lake, a series of five vertical (~50') gill nets of varying mesh sizes (9.5mm, 12.7mm, 15.9mm 19.1mm and 22.2mm barr mesh) were set on 8/25/20 and allowed to fish for two days. Nets were checked and pulled on 8/27/20 for a total of 10/net-days.

A total of 244 (24.4/net-day) Alewives captured, and is the first time alewives have been documented in East Twin Lake since 2008. The number of fish captured is very similar to the average of 24.1 fish/net-day when Alewives were at their peak abundance during 1998-2004. Based on the size of Alewives captured (size range = 72mmTL – 100mmTL), there appears to be two years classes present suggesting that Alewives returned to East Twin Lake in 2018 and may be the sole reason for the poor growth of Kokanee (see age comparison section).

Kokanee Age Comparison:

A total of 50 adult Kokanee were aged from West Hill Pond and East Twin Lake (25 fish from each lake) to determine growth differences between lakes. Kokanee were collected by angling during the summer (July and August) 2020. One local fishing guide and two avid Kokanee fishermen were tasked with catching, measuring and collecting scale samples of fish captured. Each fish was measured (TL) to the nearest 1/8" and later, measurements were converted to metric (millimeters). Kokanee scales were placed between two glass slides and ages at capture were determined by counting annuli while scale images were enlarged using a microfiche projector.

From West Hill Pond, fish ranged in size from 225mm – 425mm, and from East Twin, fish ranged from 203mm – 318mm. Average length at age was similar between lakes for age-1+ salmon, but diverged for age 2+ and age 3+ fish (Table 1).

Table 1. Average TL mm at age for Kokanee from West Hill Pond and East Twin Lake, 2020.

	West Hill Pond	East Twin Lake	Size difference between lakes by age class
Avg Total Length (mm) age 1+	225mm	209mm	16mm
Avg Total Length (mm) age 2+	321mm	253mm	68mm
Avg Total Length (mm) age 3+	401mm	296mm	105mm

Recommendations:

Based on recent findings of landlocked Alewives in East Twin Lake, and the poor growth of Kokanee especially at older ages, it is inferred that alewife abundance is currently at a level in East Twin Lake to impact growth of salmon. If Alewife abundance continues to increase, the Kokanee population in East Twin Lake may be lost completely, or growth is so poor that managing a salmon fishery is not practical.

Planned Kokanee action for calendar year 2021

East Twin Lake

- Monitor Alewife abundance in 2021 using the standard array of vertical gill nets.
- Based on the findings from vertical netting, draft a management plan for East Twin Lake designed to capitalize on the newly established Alewife forage base.

West Hill Pond

- Continue stocking of 50,000 YOY Kokanee in May and June. Clip (adipose fin) the 25,000 fingerlings slated for the June stocking to help determine if we should move toward stocking all salmon in June in the future.

Beach Pond

- Continue stocking 50,000 YOY Kokanee in May, 2021.

Appendices:

Appendix 1.–Physical and chemical information on Connecticut lakes that have been stocked with kokanee.

Lake Stocked	Years Stocked	Area (ha)	Maximum Depth (m)	Mean Depth (m)	Cond. (mmhos)	Transparancy** (m)
Current Management Lake						
West Hill Pond	1967-present	96	17.7	9.7	41	6
East Twin Lake	1959-present*	227	24	9.9	204	4
Previously Managed Lakes						
Lake Wononscopomuc	1964-2010	143	32.4	11.1	224	5.1
Historic Stockings						
Ball Pond	1964	36	15.6	6.9	222	3.4
Bashan Lake	1976-1990	106	14.1	4.8	32	4.8
Beach Pond	1964-1978; 2018-2020	159	19.5	6.1	35	4.8
Bride Lake	1965	72	NA	NA	NA	NA
Colebrook Reservoir	1968-1969	297	36.9	NA	50	NA
Crystal Lake	1970-1978	81	81.3	6	59	3.9
Dodge Pond	1970-1971	13	14.5	6.1	NA	NA
Gardner Lake	1970-1978	197	12.9	4.2	42	2.6
Highland Lake	1964-1978	180	18.6	6	82	4.1
Mashapaug Lake	1987-1990	120	12	4.5	54	4.7
Lake McDonough	2000-2002	157	18	6.6	29	9
Quassapaug Lake	1964-1969	110	19.5	8.7	48	3
Rogers Lake	1965&1969	107	19.8	6	45	3.4
Shenipsit Lake	1964-1971	212	20.4	9	65	3.4
West Branch Res.	2000-2002	81	30.6	NA	40	4.7

* Age 2 salmon were captured by the CT Board of Fish and Game, indicating that kokanee had been stocked in 1959.
** Transparancy measured by secchi disk.
NA - Information not available

Appendix 2. Historical information for number stocked and adult[a] kokanee in East Twin Lake and West Hill Pond.

	East Twin Lake			West Hill Pond		
Year	Number stocked	Avg. Adult length (mm)	Avg. number eggs/ female	Number stocked	Avg. adult length (mm)	Avg. number eggs/ female
1960	11,510	NA	NA	NS	NA	NA
1961	10,500	356	NA	NS	NA	NA
1962	13,000	381	NA	NS	NA	NA
1963	25,000	328	NA	NS	NA	NA
1964	43,500	455	1430	NS	NA	NA
1965	55,000	434	1408	NS	NA	NA
1966	81,600	384	1100	NS	NA	NA
1967	80,000	373	664	50,000	NA	NA
1968	80,000	353	NA	50,000	NA	NA
1969	50,000	343	555	NS	NA	NA
1970	50,000	378	831	NS	399	652
1971	50,000	366	821	NS	NA	NA
1972	50,000	368	670	NS	NA	NA
1973	50,000	371	696	85,000	417	NA
1974	50,000	335	NA	75,000	NA	NA
1975	50,000	310	NA	70,000	NA	NA
1976	50,000	325	NA	90,000	NA	NA
1977	50,000	333	NA	70,000	NA	NA
1978	50,000	312	NA	60,000	NA	NA
1979	50,000	312	NA	50,000	NA	NA
1980	50,000	302	NA	50,000	NA	NA
1981	50,000b	277	NA	50,000	NA	NA
1982	40,000	312	NA	50,000	NA	NA
1983	40,000	367	765	50,000	NA	NA
1984	40,000	399	NA	50,000	NA	NA
1985	40,000	345	652	50,000	NA	NA
1986	40,000	364	714	50,000	NA	NA
1987	40,000	376	788	50,000	383	NA
1988	40,000	394	824	40,000	393	928
1989	40,000c	391	939	50,000	341	NA
1990	40,000	315	560	50,000	330	286
1991	40,000d	271	NA	50,000	307	445
1992	40,000	294	NA	50,000	NA	NA
1993	40,000	272	NA	50,000	329	533
1994	40,000	255	NA	50,000	315	548
1995	40,000	268	NA	50,000	301	513
1996	NS	NC	NA	50,000	344	643
1997	40,000e	313	NA	50,000d	298	742
1998 k	NS	NC	NA	54,300f,g	297	433
1999	NS	NC	NA	50,000	314	502

Table 2. Continued.

	East Twin Lake			West Hill Pond		
Year	Number stocked	Avg. Adult length (mm)	Avg. number eggs/ female	Number stocked	Avg. adult length (mm)	Avg. number eggs/ female
2000	NS	NC	NA	50,000	375	662
2001	NS	NC	NA	50,000	417	1032
2002	NS	NC	NA	50,000	312	500
2003	NS	NC	NA	NS	357	736
2004	32,000	NC	NA	50000i	420	1056
2005	54,289	NC	NA	51284i	441	NA
2006	60,000	240	NA	60000i	364	870
2007	50,514	228	NA	50633i	366	923
2008	NS	333 [h]	NA	70000i	389	866
2009	51,400	404	NA	49,872i	360	777
2010	51,000	475	NA	50,745i	333	678
2011	51,957	436	NA	53,967i	329	NA
2012	75,000	NA[j]	NA	50,960i	342	686
2013	95,000	NA[j]	NA	51,000	375	922
2014	105,000	368	NA	52,000	431	1093
2015	80,210	368	822	51,679	463	1500
2016	76,390	317	933	51,205	473	933
2017	70,000	308	604	50,000	NC	NC
2018	74,635	311	890	53,823	445	890
2019	70,742	305	588	52,232	NC	NC
2020	71,849			51,088		

a Adult kokanee are typically age-2+ (have lived 3 summers).
b Rainbow trout no longer stocked.
c Alewives first detected or indicated.
d 5,000 fingerlings stocked into East Twin, West Hill and Wononscopomuc in the fall.
e 3,600 fingerlings stocked into East Twin in the fall.
f 27,000 CT-strain fry and 20,000 CO-strain fry were stocked into West Hill.
g 7,300 kokanee fingerlings stocked into West Hill in the fall (4,400 CT-strain; 2,900 CO-strain).
h In 2008 we captured 278 adult kokanee. This was the first year since 1990 that kokanee grew to over 12 inches.
i Beginning in 2004 all kokanee fry stocked into WHP were split between two stockings, one in mid-May and one in early June
j East Twin was not netted in 2012 or 2013
k Zebra mussels first detected in East Twin Lake
NA Information not available or incomplete.
NS No stocking of kokanee.
NC No kokanee collected.