Creation of brook trout and rainbow trout fisheries in small, landlocked ponds of Washburn County, Wisconsin, including population abundance, survival, and growth.

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Executive Summary

Spring fingerling brook trout Salvelinus fontinalis and rainbow trout Oncorhynchus mykiss have been stocked into small ponds in Washburn County since 1996 to create new fishing opportunities. Efforts were made to assess the success of these trout stockings. To sample brook trout populations, gill and fyke net surveys were conducted on two ponds where boat access was reasonable. While trout survival and growth was variable, the majority of trout stocked in the spring reach legal length (7 in) by early autumn. Age-0 brook trout population abundance was estimated at 47 and 76 per acre in the fall in the two years sampled. Survival to fall of age-0 brook trout was 24% and 39%. Angling has been the preferred tool to sample trout from walk-in ponds. By autumn, age-0 brook trout range in length from 7 to 10 in, while age-0 rainbow trout range from 8 to 12 in. Holdover (age-1+) brook trout and rainbow trout have reached 14 and 17 in, respectively. Ponds that contain fish populations (e.g. minnows) appear to grow fewer and smaller age-0 brook trout and rainbow trout. Public usage of these ponds is increasing due in part to a county sponsored web page. With a minimum amount of effort, a unique angling opportunity has been created and should be maintained. Reduced stocking densities may be beneficial on ponds that have been stocked for several consecutive years and are experiencing reduced growth or survival.

Introduction

Creating and maintaining additional and diverse angling opportunities is a continual goal of fisheries managers. County forests often can provide a plethora of outdoor opportunities for recreational use, including angling. In Washburn County there are more than 900 lakes, over half of which are small and fishless, often the result of winterkill. These waters present an opportunity to create a unique angling experience where none previously existed.

As a result of surplus hatchery spring fingerling brook trout Salvelinus fontinalis and rainbow trout Oncorhynchus mykiss in 1996, new angling opportunities were created in a small landlocked pond in Washburn County, Wisconsin. Since that time several similar ponds were stocked with spring fingerling trout annually. This report summarizes the success of these stocking efforts in accomplishing their intended objectives. More specifically, trout survival and growth was estimated in several ponds and growth monitored over a larger group of stocked ponds. In addition, general observations regarding factors affecting success of stocking are offered.

Methods

Study area. Spring fingerling brook trout and rainbow trout have been stocked in landlocked ponds in Washburn County, Wisconsin (Figure 1) since 1996. All ponds stocked were completely surrounded by public land with no development. Most of the ponds were officially unnamed but have been given unofficial names for convenience. Ponds range in size from 1 to 10 acres and in maximum depth from 7 to 25 ft. The number of ponds stocked annually has ranged from one to 18. A total of 38 ponds have been stocked at least once. As of 2004, eighteen ponds were stocked annually. The majority of these ponds were previously fishless, but some contained minnow populations. All ponds are subject to winterkill, but not every pond experiences winterkill every season. A few of the ponds have a rough boat access or a short carry-in. Most of them are located within a half mile of vehicle access, while a few require a walk of over one mile. Fishing regulations on these ponds allow the harvest of five trout measuring at least 7 in. Open season extends from the first Saturday in May through the first Sunday in March. This is a special regulation for landlocked ponds in Washburn County that was initiated in 2003 to allow for the use of these trout.

Detailed surveys were done on two ponds in 2001 and 2002. Priceless Pond is a 3.6 acre soft water, seepage pond with a maximum depth of 16 ft. Brook trout have been stocked annually in Priceless Pond since 1999. Rainbow trout were stocked in 2000 but did not survive. There is no evidence that any other species of fish were present in Priceless Pond. Big Sticks Pond is a 6.4 acre soft water, seepage lake with a maximum depth of 15 ft. Brook trout were stocked in Big Sticks Pond in 2001 but not in 2002. Brook trout have been stocked annually in Big Sticks Pond since 2003. White suckers Catostomus commersoni and an unidentified minnow species were present at the time of our survey.

Stocking. Brook trout (St. Croix strain) and rainbow trout (Erwin strain) reared at a Wisconsin Department of Natural Resources hatchery were stocked in ponds at a rate of 200-250 fish/acre within a couple of weeks after ice-out. In ponds where both species were stocked,

combined stocking densities generally did not exceed 250 fish/acre. Fish were transported to the majority of ponds in coolers carried by all terrain vehicles.

Seven hundred fingerling brook trout were stocked in Priceless Pond in April 2001 and again in 2002. Stocked fish had mean lengths of 2.4 and 2.8 in, and weighed 179 fish/lb and 100 fish/lb in 2001 and 2002, respectively. Big Sticks Pond was stocked for the first time with trout in April 2001 with 1,240 brook trout fingerling (mean length 2.4 in, 179 fish/lb).

Survival and Growth. Brook trout abundance and survival was estimated in Priceless and Big Sticks Ponds during 2001 and 2002. Three (3/4 in bar mesh) gill nets and 1 (4x5 ft frame) fyke net were set in Priceless Pond in October 2001 when water temperatures dropped to 50 F. Two of the gill nets measured 50 ft, while the third measured 250 ft. Both gill nets and fyke nets were used, because it was unclear whether brook trout would be vulnerable to fyke nets. The fyke net fished all three nights, but significant holes were present on two of the three days, decreasing the catch. All nets were set on 9 October and removed on 12 October. Nearly all fish captured in the gill nets were dead when retrieved, and the remainder was sacrificed. All fish captured in the fyke net were also sacrificed, with hopes of obtaining an abundance estimate based on removals. All brook trout were brought to a lab where they were measured to the nearest 0.1 inch, weighed to the nearest gram, and sex was determined. Sex and maturity of individual fish was determined by the presence of gametes and condition of the gonads. An index of relative weight (Wr) based on stream brook trout was used to describe and compare condition (Hyatt and Hubert 2001). Relative weight is the ratio of a fish's weight to the weight of a "standard" fish of the same length. All suitable fish were cleaned and donated to a local food pantry.

Due to the effectiveness of the fyke net and the fact that brook trout were previously not spawning, fyke nets were reset again when water temperatures dropped to the mid 40s (F). Six fyke nets were set on 22-26 October (24 net lifts). This sampling technique was also used during 2002 in Priceless Pond (13 net lifts) and in Big Sticks Pond (15 net lifts). All brook trout sampled were sexed, measured to the nearest 0.1 inch, and marked with a top caudal fin clip. Sex of individual fish was determined by the presence of gametes. Population abundance of brook

trout present after removals was estimated using the Schnabel method. The number of brook trout removed in the previous sample period was added to the Schnabel estimate to yield a pre-removal estimate of population abundance for Priceless Pond in 2001. An analysis of length frequency distribution was used to differentiate between the two year classes present. Abundance of each year class was also estimated using the Schnabel method. Survival of each year class was calculated by dividing a year class population abundance by the number of fish originally stocked from that year class. Standing crop estimates were calculated by multiplying the mean weight of individual fish in each year class by the population abundance estimate for that year class.

Angling. Brook trout and rainbow trout were also sampled in several of the ponds by hook and line. Effort and catch by WDNR personnel only was recorded. Total length was measured to the nearest 0.1 in for all trout caught. Weight was measured to the nearest gram for a subsample of the fish. Generally, the age of fish was easily determined by length, stocking history, and knowledge of the growth patterns of the individual ponds. Scale samples were taken and aged on questionable fish. Lengths of angler caught brook trout and rainbow trout were grouped by month for growth comparisons.

Results

Priceless Pond - 2001. A total of 361 brook trout were captured in Priceless Pond during the two fall sampling periods in 2001 (Figure 2). During the early sampling period 255 brook trout were removed. Length frequency distribution was similar during each survey in 2001. Mean length of all brook trout was 8.0 in (SD=1.7), ranging from 5.7 to 12.7 inches. Less than 2% of sampled fish measured 12 in or greater. Mean weight of all brook trout was 125 g (SD=88). Relative weight of all brook trout was 106 (SD=10). Population abundance after removals was estimated at 96 fish (95% C.I. 77-120) or 26.7 fish/acre. Adding this estimate to the number of brook trout removed yields a pre-removal estimate of 351 fish or 97.5 fish/acre.

Age-0 brook trout accounted for 74% of the total sample. These one-season fish averaged 7.0 in (SD=0.5) and 68 g (SD=14). Only 52% of this year class measured 7 in or greater. The largest

age-0 brook trout measured 8.4 in. None of the age-0 brook trout captured were sexable as females by observation in the field. Fish that were identified as females were done so through internal examination. Egg growth was present, but eggs were sparse and small in the 42 (30% of the dissected fish) females. All 51 (36%) age-0 male brook trout were easily identified by the presence of milt. The remaining 34% of age-0 fish showed no gamete production when dissected. Relative weight of all age-0 brook trout was 107 (SD=10). Survival of fish stocked in spring 2001 was estimated at 39% (Table 1). Standing crop of brook trout present before removals was estimated at 41.0 lb for age-0 fish (Figure 3). This is a more than ten-fold return on the biomass of brook trout stocked 6 months earlier.

Age-1 brook trout accounted for 26% of the total catch. These two-season fish averaged 10.6 in (SD=0.7) and 243 g (SD=51). Only 7% of this year class measured 12 in or longer. The largest age-1 brook trout measured was 12.7 in. All of the age-1 dissected fish could be identified as either male (33) or female (34). Relative weight of age-1 brook trout was 103 (SD=7). Two-season survival of brook trout stocked in spring 2000 was estimated at 22%. The standing crop of age-1 fish was estimated at 47.8 lb, 14 times the weight stocked a season earlier (Figure 3).

Priceless Pond – 2002. A total of 210 brook trout were captured in Priceless Pond in 2002. Mean length of all fish was 8.6 in (SD=2.0), ranging from 5.6 to 14.0 inches (Figure 2). Eighteen (9%) brook trout measured 12 in or better. Mean weight of brook trout was 153 g (SD=115). Relative weight of all brook trout was 102 (SD=11). Population abundance was estimated at 222 fish (95% C.I.= 194-256) or 61.7 fish/acre.

Age-0 brook trout accounted for 67% of the 2002 sample. These one-season fish averaged 7.3 in (SD=0.4) and 72 g (SD=12). Over 80% of this year class measured at least 7 in. The largest age-0 brook trout measured 8.1 in. None of the age-0 brook trout captured were sexable as females. Relative weight of all age-0 fish was 101 (SD=11). Age-0 brook trout standing crop was estimated at 27.7 lb, a return of 4 times the amount stocked (Figure 3). Survival of fish stocked from spring 2002 was estimated at 24%.

Age-1 brook trout accounted for 33% of the 2002 catch. These two-season fish averaged 11.3 in (SD=1.1) and 286 g (SD=83). Twenty-six percent of this year class measured at least 12 in. The largest age-1 brook trout measured 14.0 in. Females outnumbered males 53 to 13. Relative weight of all age-1 brook trout was 102 (SD=9). Two-season survival of brook trout stocked in spring 2001 was estimated at 10%. Survival of the 2001 year class from post-removal 2001 to fall 2002 was estimated at 77%. Standing crop of age-1 fish was estimated to be 42.6 lb, which is slightly greater than the biomass was estimated to be for this year class a season earlier.

Big Sticks Pond – 2002. A total of 38 brook trout were captured in Big Sticks Pond in 2002. All fish sampled were age-1. No trout were stocked in Big Sticks Pond in 2002. Mean length of brook trout was 10.1 in (SD=1.1), ranging from 8.4 to 12.5 in (Figure 4). Eight percent of sampled fish measured 12 in or better. Mean weight of brook trout was 175 g (SD=58). Relative weight of all brook trout was 86 (SD=11). Population abundance was estimated at 40 fish (95% C.I.= 31-52) or 6.2 fish/acre. Standing crop was calculated to be 15.4 lb. Two-season survival of brook trout stocked in spring 2001 was estimated to be 3%. White sucker were also captured in Big Sticks Pond. Several year classes of white sucker appeared to be present, including some large individuals. In addition, an unidentified minnow species was observed but not captured.

Angling. A total of 319 brook trout were caught and measured from 16 ponds between October 1996 and January 2005. Mean length was 8.4 in (SD=1.2), ranging from 5.2 to 12.5 in. These fish averaged 105 g (SD=54, N = 135) and ranged from 32 to 410 g.

A total of 112 rainbow trout were caught and measured from 12 ponds between October 1998 and December 2004. Mean length was 9.7 in (SD=1.8) and ranged from 7.3 and 17.0 in. These fish averaged 162 g (SD=80, N = 60), ranging from 62 to 380 g.

The large majority of angler-caught trout were age-0 fish caught during the months of August to January. Lengths of age-0 brook trout and rainbow trout generally increased from August to January (Figure 5). Age-0 brook trout averaged 7.3 in by August and 8.7 in by January. Age-0 rainbow trout averaged 8.2 in by August and 9.4 in by December. The number of age-1 trout

caught from August to January was small. Age-1 angler-caught brook trout averaged 10.7 in (N= 16) during these months, while age 1 rainbow trout averaged 12.8 in (N= 19).

Discussion

While survival of trout to their first fall was considered good in both Priceless and Big Sticks Ponds, survival was variable between years and ponds. Population abundance of brook trout in Priceless Pond was 33% greater in 2001 than in 2002. This disparity may be explained by lower survival of the 2002 year class combined with the removal of fish in the fall of 2001. A lower density of trout in 2002 likely led to the improved growth. Brook trout averaged 0.6 in longer and 28g heavier in 2002. However, lower brook trout densities did not translate to better survival for the 2002 year class, suggesting that age-0 survival was not density dependent. Good survival from fall 2001 to fall 2002 along with the abundance of age-1 fish in the fall of 2001 demonstrate that winterkill was not a significant mortality factor in Priceless Pond during those two winters.

Growth and condition of trout were variable and likely the result of any of a combination of factors. For example, relative weights of brook trout in Priceless Pond were good in both 2001 and 2002. However, age-1 brook trout were 1.2 in and 111 g smaller in Big Sticks Pond than age-1 fish in Priceless Pond despite densities that were estimated at less than 10% of that in Priceless Pond. Also, relative weights in Big Sticks Pond were considerably lower than in Priceless Pond. The presence of white sucker is likely the reason for both poor survival and growth of the 2001 year class in Big Sticks Pond. White sucker likely competed for limited food resources available. Gowing (1986) also reported poor growth of brook trout in small Michigan lakes in the presence of white sucker.

Data and observations from several years of pond stocking suggest that very warm summer water temperatures suppress survival and/or growth (L. Damman, WI DNR, personal communication). In addition, other factors, such as bird and mammal predation, annual

fluctuations in invertebrate populations, and variables associated with the stocking process, likely contribute to variation in survival.

Pond morphology may have some contribution on trout survival. Some of the deeper, dark water ponds have experienced substantial oxygen depletion during the summer months. While shallow ponds (<10 ft) may warm to higher temperatures, sunlight penetrates throughout the water column, maintaining oxygen levels. Trout in these ponds have shown the ability to survive fairly high water temperatures (80 F) even though these temperatures appear to diminish growth. Both brook trout and rainbow trout have survived where summer water temperatures have been recorded as high as 83 F. In contrast to what Gowing (1986) found in small Michigan lakes, Washburn County ponds that contain minnow populations have typically produced fewer and smaller first-year trout. This contrast is probably explained by the larger size at which Gowing's (1986) trout were stocked. Fishless ponds that are stocked for the first time usually experience excellent growth, as trout take advantage of unexploited invertebrate populations.

Our stocking experiences have made it apparent that some ponds are better suited for either brook or rainbow trout. Brook trout have shown the ability to survive periods of low oxygen in these ponds better than rainbow trout. Brook trout have survived winters where dissolved oxygen has been measured at less than 1 ppm. It has been uncommon for rainbow trout to overwinter. In several instances, when both species have been present in the fall, brook trout have survived the winter while rainbow trout have not. Rainbow trout have shown the ability to survive very warm summer water temperatures better than brook trout. This has been especially true in the shallowest ponds where water temperatures are the highest. Isely and Kempton (2000) found decreased growth of young-of-the-year brook trout under optimum environmental conditions when raised with young-of-the-year rainbow trout that were stocked at similar sizes. They suggested that this effect could be magnified under warmer temperatures. Stocking rainbow trout exclusively may produce the best results in our shallowest ponds. Stocking of rainbow trout in some of the ponds has been discontinued due to consistently poor survival.

The domestic strain of brook trout that has been stocked typically survives only two seasons, even under optimal conditions. The few instances where brook trout have survived into a third season occurred after they did not mature in their first season. The energy saved by not producing gametes in their first year apparently allowed these brook trout to survive into a third season.

The Erwin strain of rainbow trout can survive more than two seasons. While this has not been documented in these ponds, knowledge of growth in individual ponds suggests that third season rainbow trout have been present. This strain of rainbow trout typically spawns in late summer. However, very few mature rainbow trout have been observed. It is likely that few, if any, rainbow trout become mature in their first summer in these ponds, making it more likely that they could survive into a third season.

It is likely that a decrease in stocking density would result in improved first-year growth. However, high angler catch rates are desired, and the majority of trout do grow to legal harvest length by autumn. Fingerling trout are fairly inexpensive to raise and require relatively little effort to stock. Considering the large number of ponds stocked each year, there are opportunities to experiment with different stocking rates and trout strains on some of the ponds.

While the data collected from angling is limited due to sample size and the lack of data from some of the ponds, it demonstrates that the majority of spring fingerling trout reach legal harvest size by late summer in these ponds. When able to overwinter, brook trout and rainbow trout have reached impressive sizes by the end of their second growing season. Angling success is best in late summer to early winter. Spring and summer fishing will only be productive on ponds where fish overwinter.

Conclusions and Management Recommendations

1. Stocking of spring fingerling brook trout and rainbow trout has created a unique angling opportunity in numerous small, landlocked ponds of Washburn County, Wisconsin and

should be continued. Use of these ponds is increasing, catch rates are high, and anglers are pleased with the results.

2. Stocked fingerling brook trout and rainbow trout grow rapidly in fishless ponds. In the fall of their first season brook trout and rainbow trout typically average 7 to 10 in. Fish that survive to their second fall typically average 10 to 14 in, but anglers have reported fish up to 20 in. Survival to first fall is usually good and fall trout densities are typically high. However, winterkill is common.

3. Consideration should be given to altering stocking strategies in some of the ponds. Decreasing stocking densities may lead to even better growth without significantly affecting catch rates. Stocking only rainbow trout in the shallowest ponds may maximize production. Stocking only brook trout in ponds with historic lower winter dissolved oxygen levels may increase overwinter survival. Brown trout Salmo trutta may be a suitable alternative, especially in the ponds that contain minnows. Due to the number of ponds available, there is little to lose by altering stocking rates in some of the ponds. Continued monitoring of the ponds by angling will help assess growth, survival, and effects of any stocking alterations.

4. Continued promotion of the trout ponds is important. A county-sponsored website (www.co.washburn.wi.us/departments/forestry/info/troutfishing/index.htm) has helped anglers become aware and familiar with the ponds and their locations. Word of mouth has also been an effective method of introducing anglers to this opportunity.

Acknowledgments

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Hyatt, M.H., and W.A. Hubert. 2001. Proposed standard-weight equations for brook trout. North American Journal of Fisheries Management 21:253-254.

Isely, J.J. and C. Kempton. 2000. Influence of costocking on growth of young-of-year brook trout and rainbow trout. Transactions of the American Fisheries Society 129:613-617.

Table 1. Brook trout population abundance and survival from stocking (%) by year class, Priceless Pond and Big Sticks Pond 2001 and 2002.

			Sampling Year	
Year Class	Lake	Number Stocked	2001	2002
2000	Priceless	400	89 (22%)	--
2001	Priceless	700	274 (39%)	68 (10%)
2001	Big Sticks	1,240	--	40 (3%)
2002	Priceless	700	--	170 (24%)

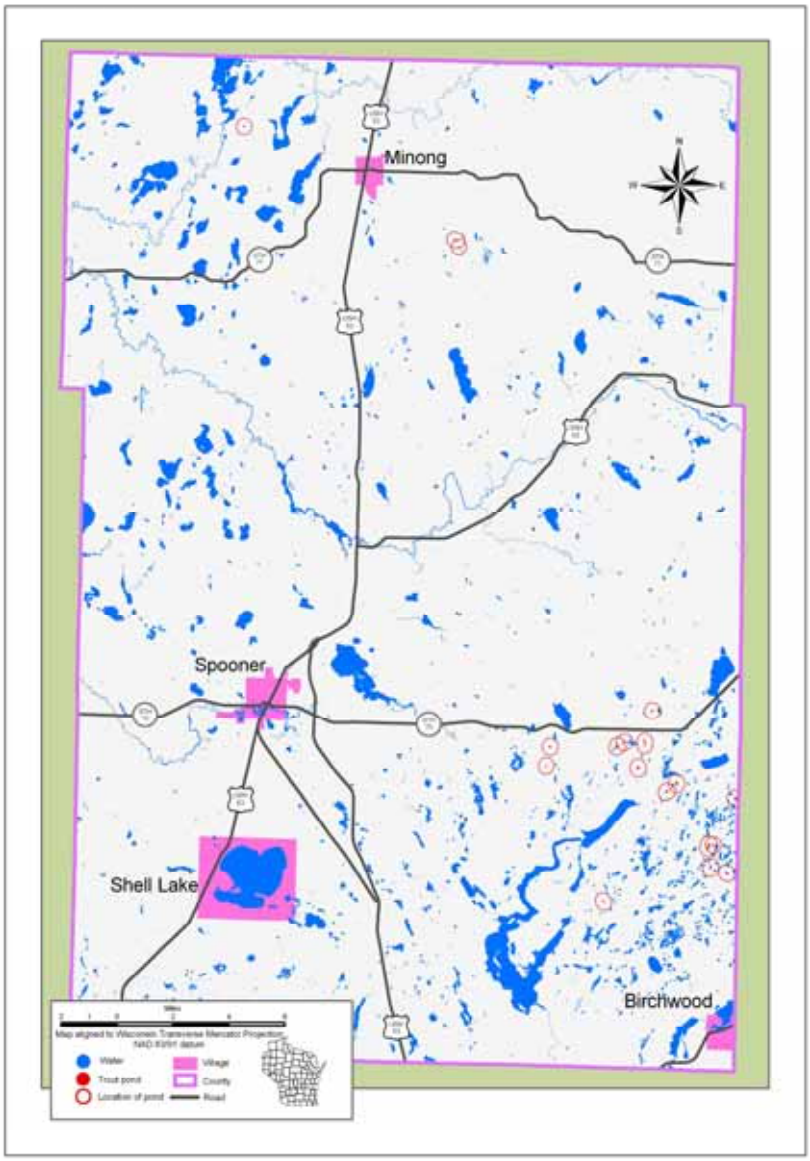

Figure 1. Locations of stocked trout ponds, Washburn County, Wisconsin, 2004.

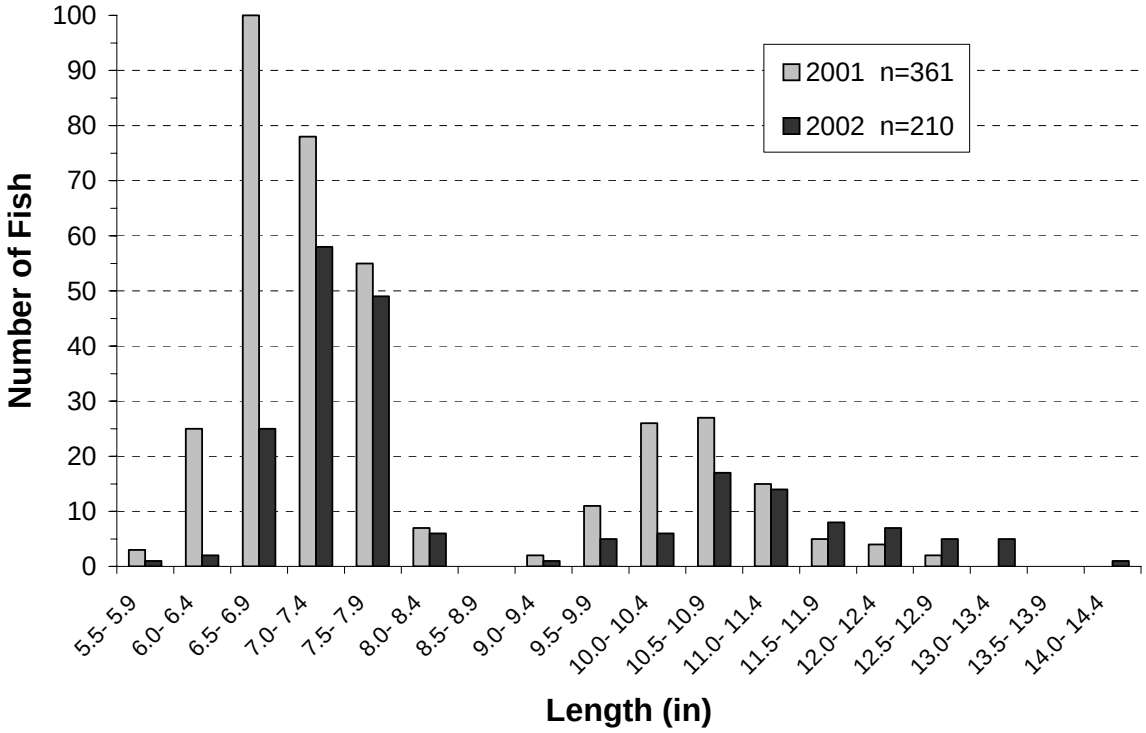

Figure 2. Length frequency distribution of brook trout captured in Priceless Pond, 2001 and 2002.

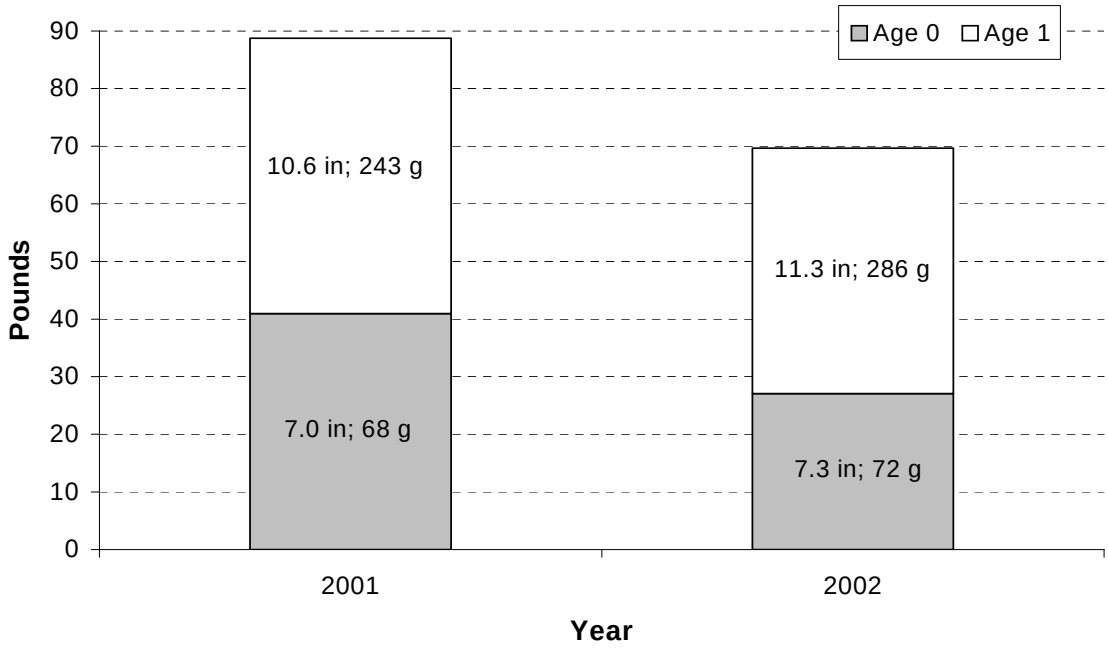

Figure 3. Standing crop of brook trout in Priceless Pond, 2001 and 2002. Mean length and weight of age classes is inside bars.

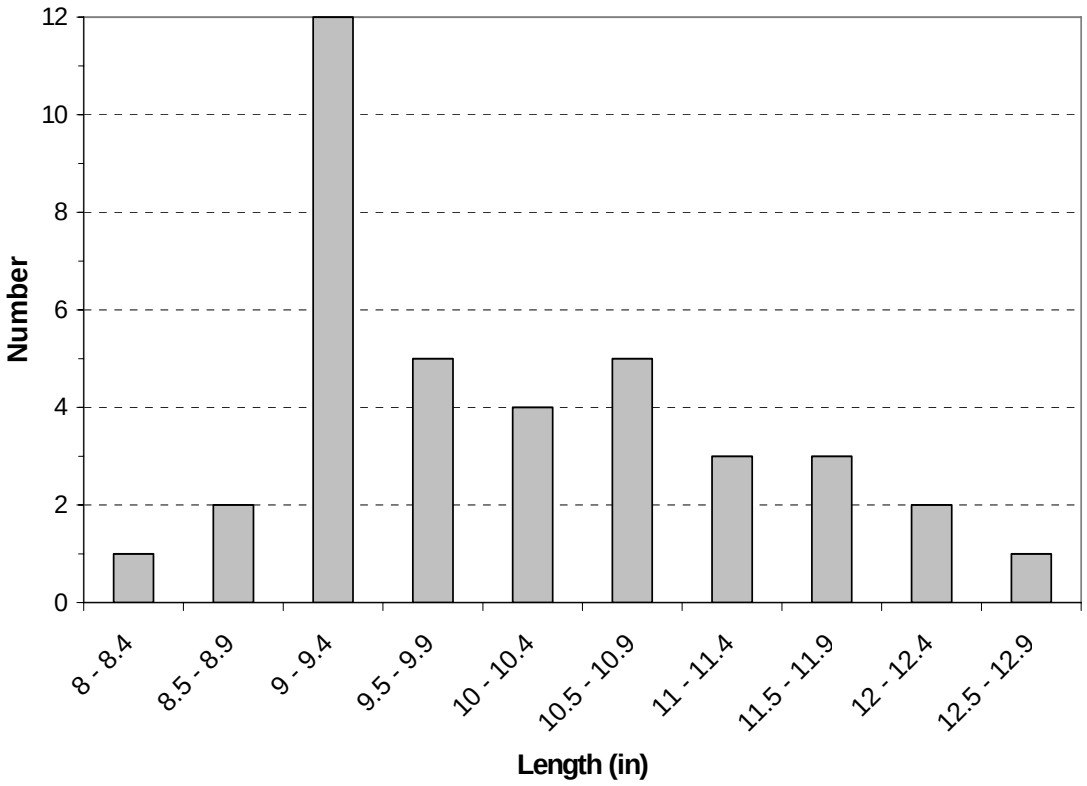

Figure 4. Length frequency distribution of age-1 brook trout captured in Big Sticks Pond, 2002, N=38.

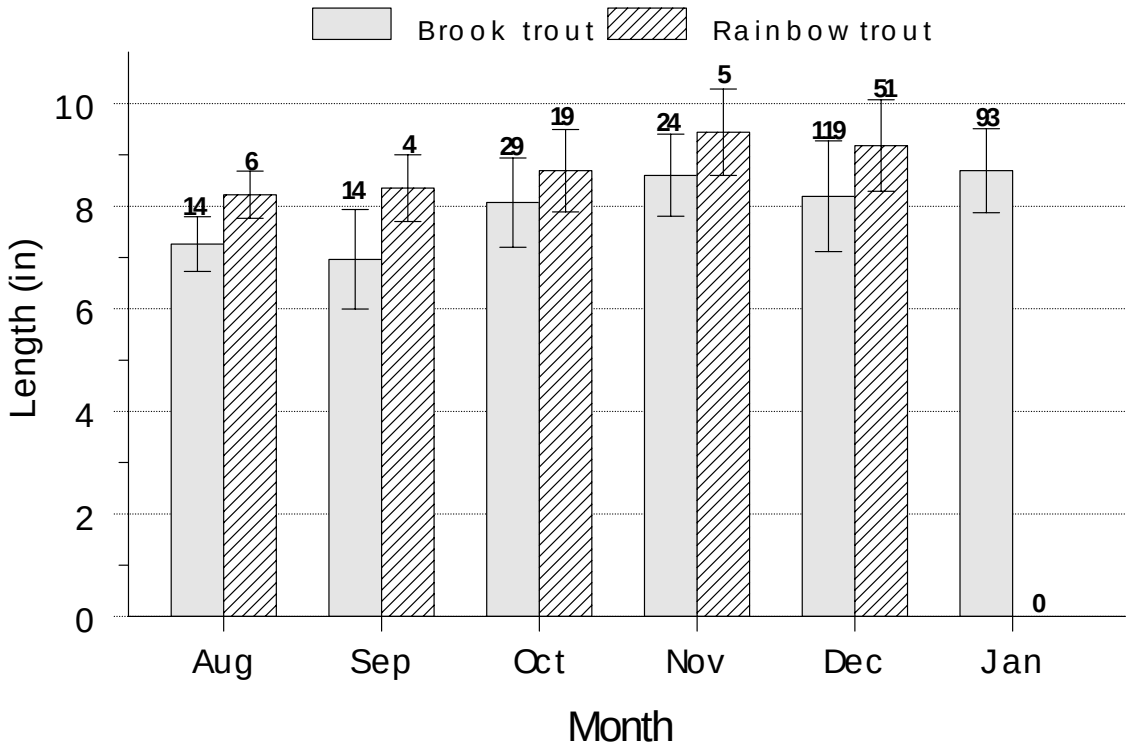

Figure 5. Mean length (±1 SD) of age-0 angler-caught brook trout and rainbow trout in Washburn county trout ponds, 1996-2005. Sample size is above error bars.