Red Cedar Chain of Lakes
Treaty Assessment Survey
Barron and Washburn Counties, Wisconsin
2005-2006
MWBIC (2109600, 2109800, 2112800)

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Executive Summary

The Red Cedar Chain of Lakes was surveyed in 2005-2006 following the Wisconsin Department of Natural Resources Treaty Assessment Protocol. Projected angler effort for all species of fish was 40.8 hours per acre. Walleye abundance in 2005 was estimated at 2.2 adult fish per acre. This is a 25% and 44% decline when compared to past surveys in 1992 and 1980. At this time, angler harvest rates appear to be limiting the abundance of walleye in the Red Cedar Chain. A walleye regulation change is recommended to increase the abundance of walleye in the Red Cedar Chain and restore adult walleye densities to 4.0 fish per acre.

Smallmouth bass were more common (2.5 adult fish per acre) than largemouth bass (1.7 adult fish per acre) on Red Cedar Lake. However, the size structure of largemouth bass was better based on Relative Stock Density values. Largemouth bass densities should remain low and anglers are encouraged to harvest largemouth bass in the 14-16 inch size range to minimize any potential secondary impacts to the walleye population. Smallmouth bass and northern pike densities should remain stable and each provides a desirable fishery at this time.

Several concerns were noted with the panfish community. Bluegill harvest rates were very high on Hemlock Lake and a decline in the abundance of yellow perch was documented on Red Cedar Lake. Regulation changes are recommended to improve panfish size structure, abundance as well as maintain a quality panfishery on the Red Cedar Chain of Lakes.

Introduction

The Red Cedar Chain of Lakes, a 2,493-acre waterbody consisting of Red Cedar, Hemlock and Balsam Lakes, are located near Birchwood in northeastern Barron and southeastern Washburn Counties, Wisconsin. The Red Cedar River enters Balsam Lake and exists Red Cedar Lake where an 11 foot dam is present. In addition, Hemlock Creek enters Hemlock Lake.

Red Cedar Lake is the largest lake in the chain at 1,841 acres, followed by Hemlock Lake at 357 acres and Balsam Lake at 295 acres. The Red Cedar Chain of Lakes has a diverse fishery consisting of walleye Sander vitreus, northern pike Esox lucius, smallmouth bass Mircropterus dolomieui, largemouth bass Micropterus salmoides as well as bluegill Lepomis macrochirus, black crappie Pomoxis nigromaculatus, pumpkinseed Lepomis gibbosus, green sunfish Lepomis cyanellus, yellow perch Perca flavescens, rock bass Ambloplites rupestris, bowfin Amia calva, cisco Coregonus artedii, white sucker Catostomus commersoni, and bullheads Ameiurus spp. Fish movement was documented between the three-water chain during the 2005-2006 creel census survey. However, angling pressure and fish community composition is different between each lake. For the purposes of this report, data was presented separately for each lake except for walleye. Walleye population parameters were reported by individual lake as well as combining the data from Balsam and Red Cedar Lakes where most of the fish movement was documented. The Red Cedar Chain is considered to be within the native range of walleye in Wisconsin (Becker 1983). Even though this is the case, a long history of fish stocking has occurred over the past century (Table 1). Walleye was the main focus of fish stocking efforts on Red Cedar and Balsam Lakes. From 1933 to 1973 consistent stocking of fry and small fingerling walleye occurred. In 1973, walleye stocking was terminated because it was felt that natural reproduction was sufficient to maintain the population. However, from 1992-2004, small fingerling walleye stocking was reinstated because of concerns with low adult walleye abundance. In addition, in 2004-2006 walleye fry were reared and stocked into Red Cedar Lake by using a portable fish hatchery (Walleye Wagon) by the local Walleye's for Tomorrow Chapter. Smallmouth and largemouth bass were also sporadically stocked in Red Cedar Lake from the 1940s to 1977 and stocking of 7,925 adult black crappie occurred in 1984 and 1985. Stocking events on Hemlock Lake consisted of mainly walleye from 1933 to 1977. Walleye stocking in Hemlock Lake was terminated in 1977 because of poor stocking success. In addition, largemouth bass and northern pike were stocked sporadically into Hemlock Lake from 1937-1954.

The minimum length limit for walleye on the Red Cedar Chain of Lakes was 15 in with a daily bag that fluctuates on an annual basis dependent on annual safe harvest estimates. The minimum length limit for bass was 14 in with a daily bag of five fish. No minimum length limits are in effect for northern pike or panfish and the bag limits were five and 25, respectively.

Prior to this fish survey, fish management goals for the Red Cedar Chain were: 1) Maintain an adult walleye population in Balsam-Red Cedar Lake of at least 3.0 adult fish per acre, with 3.5-4.5 fish/acre as a preferred range. 2) At least 10% of the spring fyke-netted walleye should be 20 in or longer. 3) Maintain a northern pike population of 3.0-5.5 adult fish per acre (Cornelius 1993). The objectives of this study were to assess the status of the walleye population as part of the treaty assessment sampling rotation of lakes for the Ceded Territory of Wisconsin. Secondary objectives included assessing the status of other important fish species such as bass, northern pike, and panfish.

Methods

The Red Cedar Chain of Lakes was sampled during 2005-2006 following the Wisconsin Department of Natural Resources treaty assessment protocol (Hennessy 2002). This sampling included spring fyke netting and electroshocking to estimate walleye abundance, fall electroshocking to estimate year class strength of walleye young-of-the-year (YOY) and gamefish relative abundance as well as a creel survey (both open water and ice). Walleye abundance was determined for adult fish only. Adult walleye were defined as being $\geq$ 15 in or sexable (Hennessy 2002). Adult walleye abundance for Balsam and Red Cedar Lakes were combined because it was felt considerable spawning movement of walleye occurs in the spring months between Balsam and Red Cedar Lakes (Cornelius 1993). In addition, smallmouth and largemouth bass mark and recapture population estimates were generated for Red Cedar Lake using spring electrofishing surveys. In the fall of 2005 and 2006, YOY walleye were sampled using night-time electrofishing to determine the survival/contribution to the year-class from a stocking of fry using a Walleye Wagon. Fry were chemically marked with oxytetracycline (OTC) according to Brooks et al. (1994) lakeside prior to stocking. Otoliths from subsamples of age-0 walleye sacrificed were viewed for marks (Jennings et al. 2005).

Creel census data were collected on the Red Cedar Chain in 2005-2006 beginning the first Saturday in May and continuing through 5 March of the following year (the open season for game fish angling in Wisconsin). No creel survey data were collected during November because thin ice created dangerous

fishing conditions. Creel survey methods followed a stratified random design as described by Rasmussen et al. (1998). Walleye exploitation rates were calculated using the proportion of finclipped walleye (from spring population estimates) observed and measured during the creel survey. This method is preferred for determining angler mortality, but can underestimate mortality if fin clipped fish are not identified during the creel census survey.

Data collected during the 2005-2006 survey were compared with previous fish surveys on the Red Cedar Chain in 1980 and 1992. In addition, northern pike catch and harvest statistics were compared with 55 northern Wisconsin lakes (Margenau et al. 2003). Growth data were compared with local (Barron and Polk County) and regional (18 county WDNR Northern Region) means utilizing the WDNR Fisheries and Habitat database. Age assessment for walleye and bass was determined from both scale samples (< 12 in) and dorsal spine sections (≥ 12.0 in). Juvenile walleye (YOY) electrofishing runs were conducted in 1990, 1997, 1998, 1999, 2000, 2002, 2003, 2004 and 2005. Size distributions for bass were summarized using relative stock density (RSD) values (Anderson and Neumann 1996). Relative stock density is the number of fish greater than a stock length (e.g. largemouth bass, 8 in; smallmouth bass, 7 in) that are greater than a designated length (e.g. 14 in) and expressed as a percent.

Results

Angling Effort. Projected angling pressure for all species in 2005-2006 on the Red Cedar Chain was 40.8 hrs/acre. The heaviest angling pressure was on Hemlock Lake at 77.2 hrs/acre followed by Balsam Lake at 53.3 hrs/acre and Red Cedar Lake at 31.8 hrs/acre (Table 2). Angling pressure between lakes targeted different species (Table 3).

Walleye. In 2005, the combined adult walleye population in Red Cedar and Balsam Lake was 4,721 or 2.2 fish/acre (95% C.I. 3982-5460). Walleye abundance in 2005 was 25% and 44% lower when compared to previous surveys in 1992 and 1980 respectively (Figure 1). In 2005, the adult walleye population in Hemlock Lake was 162 or 0.5 fish/acre (95% C.I. 101-222). Growth of walleye in Red Cedar Lake was good. Growth rates for age 3 through 7 walleye increased by an inch per age group from previous surveys in 1992 (Table 4). In addition, walleye growth was similar to slightly above the local mean and faster than NOR regional mean (Table 5).

Walleye YOY were collected in every year sampled since 1990 on Red Cedar Lake. Mean YOY abundance was 35 fish/mile since 1990 (N=9, range=10-67 fish/mile). Most recently, strong walleye year

classes were present in 2000, 2004 and 2005 (Table 1). Walleye fry stocking contribution from the walleye wagon was documented during both 2005 and 2006. Stock contribution was estimated at 5.4 YOY/mile and 6.4 YOY/mile respectively (Figure 3). In comparison, natural recruitment of fall YOY walleye was estimated at 61.8 YOY/mile in 2005 but considerably lower in 2006 at only 2.4 YOY/mile.

Angling effort for walleye made up 27% (24,608 hrs) of the total directed effort (open water and ice combined) on Red Cedar Lake in 2005-2006. Specific catch and harvest rates for Red Cedar Lake were 4.4 hrs/ walleye caught and 10.0 hrs/walleye harvested. Directed angling effort for walleye was much lower on Balsam Lake (13%) and Hemlock Lake (3%). Not surprisingly, specific catch rates for walleye were also considerably lower on Balsam Lake at 18 hrs/fish caught and 68 hrs/fish harvested. No walleye harvest was documented from Hemlock Lake (Table 3). Mean length of walleye harvested was similar between Red Cedar Lake 17.0 in (SE = 0.19, N = 103), and Balsam Lake 16.9 in (SE = 0.42, N = 6). Most (75%) of walleye harvested on Red Cedar Lake in 2005-2006 were less than 18 inches (Figure 2).

In 2005, tribal spear fishers harvested 377 walleye from Red Cedar Lake and 43 walleye from Balsam Lake. Total adult walleye exploitation was estimated at 34% for Red Cedar and 29% for Balsam Lake.

Smallmouth bass. In 2005, the adult smallmouth bass population on Red Cedar Lake was 4,586 or 2.5 fish per acre (95% C.I. 3,004-6,167). Seventeen percent or 15,373 hours of directed angling effort (open water and ice combined) was targeted towards smallmouth bass. Projected angler harvest was 676 fish during the open water and ice fishing periods combined on Red Cedar Lake. Smallmouth bass harvest was not documented in Balsam or Hemlock Lake during the creel census. Mean length of smallmouth bass harvested in Red Cedar Lake 2005-2006 was 16.5 in (SE=0.46, N= 40).

Smallmouth bass size structure decreased from 1992 to 2005. RSD-14 in 2004 was 24 compared to 36 in 1992. Growth of smallmouth bass was good (Table 6). More specifically, the mean length of a 5 year old smallmouth bass was 14.8 in (SD=0.3, N=7).

Largemouth Bass. In 2005, the adult largemouth bass population on Red Cedar Lake was 3,075 or 1.7 fish/acre (95% C.I. 1781-4368). Eleven percent or 10,160 hours of directed angling effort (open water and ice combined) targeted largemouth bass in 2005-2006. Projected angler harvest for largemouth bass in 2005-2006 was only 133 fish during the open water and ice fishing periods combined. Mean length of largemouth bass harvested on Hemlock and Balsam Lakes was 15.2 in (SE = 0.21, N = 31) and 14.8 in (SE = 0.39, N= 5) respectively. Only one largemouth bass was measured on Red Cedar Lake.

Largemouth bass size structure decreased on Red Cedar Lake from 1992 to 2005. RSD-14 was 31 in 2005 compared to 41 in 1992. Growth of largemouth bass in Red Cedar Lake was good (Table 7). More specifically, the mean length of a 5 year old largemouth bass was 14.1 in, (SD=0.9, N = 9).

Northern Pike. Northern pike abundance was not estimated during the 2005 sampling event. Projected angler harvest including both open water and ice angler harvest was highest on Hemlock Lake (N=430) followed by Red Cedar Lake (N=416) and Balsam Lake (N=251). Mean length of northern pike harvested in 2005-2006 was highest on Red Cedar Lake at 23.8 in (SE=0.72, N = 26) followed by Hemlock Lake at 22.1 in (SE = 0.63, N = 39) and lastly Balsam Lake 21.6 in (SE = 0.60, N = 42). Angler harvest rates were highest on Balsam and Hemlock Lakes (0.06 fish/hour) and slightly lower on Red Cedar Lake at (0.05 fish/hr).

Bluegill: Bluegill directed angler effort was highest on Hemlock Lake at 37%, followed by Balsam Lake at 19% and Red Cedar Lake at 17%. Projected harvest for bluegill was also highest on Hemlock Lake (N=32,222), followed by Red Cedar Lake (N=16,802) and Balsam Lake (N=4,834). However, mean length of bluegill harvested was highest on Balsam Lake at 7.6 in (SE = 0.08 , N = 131) followed by Red Cedar Lake at 7.5 in (SE = 0.04, N = 295) and lastly Hemlock Lake at 7.2 in (SE = 0.03, N= 637). Projected harvest for bluegill was very high on Hemlock Lake at 90 fish/acre compared to Balsam and Red Cedar Lakes at only 16 at 9 fish/acre respectively. More specifically, projected bluegill harvest on Hemlock Lake was 266% higher than the mean (25 fish/acre, n=10) when compared to 9 other local lakes where creel surveys occurred since 2000 (Table 8).

Black Crappie: Directed effort by angler for black crappie was highest on Hemlock Lake (19%) followed by Balsam Lake (12%) and Red Cedar Lake (6%). Projected harvest for black crappie was also highest on Hemlock Lake (N=5,035), Red Cedar Lake (N=1,088) and Balsam Lake (N=774). However, mean length of black crappie harvested was once again highest on Balsam Lake 10.2 in (SE = 0.19, N = 54) followed by Hemlock Lake 9.6 in (SE = 0.11, N = 130) and Red Cedar Lake 9.3 in (SE = 0.13, N = 26).

Yellow Perch: Yellow perch relative abundance (catch per unit of effort) decreased from 4.0 fish/net lift in 1992 to 1.6 fish/net lift in 2005. Angler directed effort for yellow perch was highest on Red Cedar Lake at 10% followed by Balsam Lake at 5%. No directed effort for yellow perch was documented on Hemlock Lake. Projected harvest for yellow perch was 2,550 and 970 on Red Cedar and Balsam Lakes, respectively. Mean length of fish harvested was higher on Red Cedar Lake 10.3 in (SE = 0.15, N = 144) compared to Balsam Lake 8.1 in (SE = 0.12, N = 66).

Discussion

Walleye: Adult walleye abundance decreased 44% from 1980-2005. This decrease is likely related to angler harvest. Total estimated exploitation (angler and tribal harvest) was 34% for Red Cedar Lake and 29% for Balsam Lake. It is recommended that adult walleye mortality should not exceed 35% of the estimated adult population (Hennessey 2002). Interestingly, lower walleye abundance is not likely from recruitment failures. Walleye recruitment has been strong (mean = 35 YOY/mile) since 1990. In 1992, the management strategy was to reinstate walleye small fingerling stocking because walleye abundance was decreasing and below the existing management goal of 3.5 to 4.5 adult walleye per acre. If walleye recruitment would have been the main limiting factor, stocking additional small fingerling walleye from 1992-2004 should have increased the adult walleye population. This did not occur and the walleye population has continued to decline. Addressing angler harvest with a regulation change should increase adult walleye densities.

Supplemental fry stocking from the walleye wagon did contribute to both the 2005 and 2006 year classes. In 2005, the benefit of the supplemental stocking was not very large considering 92% of the fall year class was from in-lake natural reproduction. However, in 2006, 73% of the fall year class was from fry stocked from the walleye wagon. Interestingly, fry contribution during both years was similar (5.3 fish/mile-2005 and 6.4 fish/mile-2006).

The need to continue walleye small fingerling stocking from state hatcheries should be reevaluated. Natural reproduction has been consistent over the past 15 years and additional recruitment was documented from the experimental walleye wagon operation in 2005 and 2006. Recent studies have suggested that stocking fish on top of native fish populations could adversely impact the genetic makeup of the native strain by introducing non-native strains of fish (Philipp 1991). In addition, WDNR guidelines suggest that lakes with sufficient natural reproduction should not be stocked. In the case of Red Cedar Lake, natural reproduction appears to be sufficient and angler harvest appears to be the limiting factor effecting walleye abundance.

Smallmouth Bass: Smallmouth bass were more abundant than walleye in Red Cedar Lake. Smallmouth bass, along with walleye should be considered the two primary species of management in Red Cedar Lake. Smallmouth bass are not thought to negatively impact walleye populations in Wisconsin lakes (Fayram et al. 2005). Red Cedar Lake is one of a handful of lakes in Barron County that has a fishable population of smallmouth bass. Smallmouth bass size structure has decreased from 1992 to 2005. Management efforts for smallmouth bass should focus on maintaining a quality size structure as well as enhancing smallmouth bass habitat. Overall, management objectives for adult smallmouth bass should be to maintain the adult population at 3.0 adult fish per acre, with RSD-14 values between 30-40. This management strategy would maintain the existing density and attempt to increase the size structure of smallmouth bass.

Largemouth Bass. Largemouth bass abundance was low at only 1.7 adult fish/acre. Considering walleye are the dominate fish targeted by anglers in Red Cedar Lake, largemouth bass should be managed as a secondary species of importance in the Red Cedar Chain. Largemouth bass can have negative impacts on native walleye populations. Nate et al. (2003) indicated that high largemouth bass and northern pike densities characterized lakes with walleye populations that are maintained by stocking versus natural reproduction. Four other studies completed on nearby Ward, Half Moon, Big Butternut and Lower Turtle Lake (Benike 2006a; Benike 2006b, Benike 2005a, Benike 2005b) in neighboring waters also showed a similar trend of decreasing walleye abundance with an increase in largemouth bass abundance over the past 10-15 years. Fayram et al. (2005) documented that largemouth bass interact strongly with walleye populations through predation as well as, limit stocked walleye survival. The authors further suggest that management goals seeking to simultaneously maximize both largemouth bass and walleye populations may be unrealistic. Considering the Red Cedar Chain is one of the few lakes in Barron County that has a strong walleye population supported by natural reproduction, no management efforts should be undertaken to

improve the size structure or density of largemouth bass. In addition, if future surveys indicate that largemouth bass densities are expanding on the Red Cedar Lake Chain, aggressive management actions should be pursued to reduce largemouth bass densities to less than 2.0 adult/fish acre (approximate current population). Anglers should be encouraged to harvest largemouth bass from the Red Cedar Chain of Lakes. The creel census indicated that little if any angler harvest of largemouth bass occurred.

Northern Pike The 2005-2006 creel indicated that angler effort and catch rates were similar but angler harvest rates were slightly lower (0.05-0.06 fish/hr) on all three lakes to those noted for 55 northern Wisconsin lakes (0.07 fish/hr) by Margenau et al. (2003). Nate et al. (2003) indicated that high largemouth bass and northern pike densities characterized lakes with walleye populations that are maintained by stocking versus natural reproduction. Considering the Red Cedar Chain of Lakes has strong walleye natural reproduction, anglers are encouraged to harvest northern pike to minimize any potential impacts to the natural reproducing walleye population. No management actions should be taken to increase the size structure or abundance of northern pike.

Panfish. Bluegill was the most common panfish captured and the mean length harvested was good on Red Cedar and Balsam Lakes, however the mean length of bluegill harvested on Hemlock Lake was nearly 0.3-0.4 inches smaller. In addition, bluegill harvest was very high on Hemlock Lake at 90 fish/acre and 266% above the local mean. Based on the number of bluegill caught/angler during the creel survey, a 10 bag limit imposed on bluegill would reduce bluegill harvest by 22% on Hemlock Lake. The ten bag limit would also only reduce bluegill harvest between 8-9% on Red Cedar and Balsam Lakes. In an effort to improve the mean length of bluegill harvested on Hemlock Lake and maintain a quality bluegill fishery on Red Cedar and Balsam Lakes this regulation change should be considered. Yellow perch abundance has decreased since 1992 and several complaints have been received in regards to a decrease the quality and quantity of the yellow perch fishery on Red Cedar Lake. In 2005, a local resolution was passed at the Barron County Conservation Congress Hearing supporting a bag reduction for yellow perch on the Red Cedar Chain from 25 to 10. Based on creel census data a bag reduction to 10 would reduce yellow perch harvest 8% on Balsam Lake and have no impact harvest on yellow perch harvest on Red Cedar or Hemlock Lakes. This regulation change has minor use if it was targeted only for yellow perch, however with the documented high harvest of bluegill on Hemlock Lake a 10 bag limit in total for panfish makes this regulation more appealing. In addition, if yellow perch recruitment increases, this regulation will serve as a protective measure to minimize harvest of yellow perch. Considering the documented decline in yellow

perch over time, another alternative that could be considered is to increase recruitment by restocking yellow perch into the Red Cedar Chain of Lakes. The most logistical possibility would be to collect gametes in the spring of the year, hatch and raise those fish in outlying ponds to the fall fingerling stage and then restocking those fish back into the Red Cedar Chain of Lakes.

The mean size of black crappie harvested is good and the proposed 10 bag limit for panfish would cause a minor reduction in black crappie harvest (less than 10%) on the Red Cedar Chain of Lakes.

Management Recommendations

1. In an effort to reduce angler harvest and increase the adult walleye population to 4 adult fish per acre, a walleye regulation change is recommended. Based on all available options at this time, a 18 inch minimum length limit with a daily bag of 3 is recommended for a 8-10 year period and be re-evaluated to determine its effectiveness. Angler and local landowner support appears strong for this regulation option based on several meetings held with local stakeholder groups.

2. Walleye small fingerling stocking should be eliminated for the Red Cedar Chain. Walleye recruitment has been adequate (35/mile) and recent studies have suggested that stocking additional walleye on top of a native walleye population could adversely impact the genetic composition of the existing walleye stock. In addition, the stocking that has been done has not been effective in improving the adult population because the limiting factor appears to be angler harvest.

3. It appears the supplemental stocking of walleye fry using a portable fish hatchery was successful in Red Cedar Lake. In addition, this stocking strategy reduces genetic concerns because the fish used for stocking are taken from the same water. Considering this, walleye fry stocking using a portable fish hatchery can continue on Red Cedar Lake assuming local volunteers are able to fund and run the operation.

4. Smallmouth bass adult densities should be maintained between 2-4 adult fish per acre, with RSD-14 values in the range of 30-40.

5. Largemouth bass adult densities should be maintained at less than 2.0 adult bass/acre. If largemouth bass densities increase above 2.0 adult bass/acre, largemouth bass regulations should be liberalized to encourage harvest of surplus fish. Anglers are also encouraged to harvest largemouth bass in the 14-16 inch range because they are common in the population. This would minimize largemouth predation on walleye and it would help maintain largemouth densities in their current condition.

6. Northern pike are present and appear to provide adequate angling opportunities at this time. No additional management is recommended to increase their abundance or size structure.

7. A reduction in the panfish daily bag limit from 25 to 10 should be considered for the Red Cedar Chain of Lakes. Bluegill harvest is very high on Hemlock Lake and mean length harvested is poorer when compared to Red Cedar and Balsam Lakes. In addition, concerns have been expressed that the yellow perch fishery has declined over time on the entire Red Cedar Chain of Lakes. This regulation change would also reduce yellow perch harvest on Balsam Lake and minimize harvest of future yellow perch year classes in the Red Cedar Chain of Lakes.

8. Consideration should be given to supplementing the existing yellow perch population with stocked fall fingerling yellow perch. Yellow perch gametes could be collected from Red Cedar Lake and reared in outlying ponds formerly used as walleye rearing ponds by Governor Thompson Hatchery in Spooner.

9. Littoral zone areas should be protected to provide critical spawning, nursery and overwintering habitat for the existing fish community in the Red Cedar Lake Chain. No large-scale chemical treatment of aquatic plants is recommended, unless deemed appropriate at some future point. Minor chemical treatments for navigational purposes should be considered on a case by case basis.

10. Lake shore property owners should maintain or restore at least a 35 foot vegetative buffer to maintain near shore habitat and to protect the water quality of the Red Cedar Chain of Lakes. Elimination of protective lakeshore buffers will likely lead to an increase in nutrients that will likely contribute to an increase in algae blooms and a decrease in overall water quality and fish habitat.

11. Rocky substrate, such as rubble, cobble or gravel is critical spawning habitat for walleye and

smallmouth bass in the Red Cedar Lake Chain. Destruction or any measures that may adversely impact the condition of rocky substrate should be highly scrutinized and if possible prevented. In addition, adjacent landowners who have rocky substrate within their riparian zone should also be cognizant of rocky substrate and manage their adjoining property in a manner that avoids and minimizes any impacts to the critical habitat feature.

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Table 1. Walleye small fingerling stocking and fall fingerling catch per unit of effort (CPUE) from fall electrofishing for Red Cedar Lake, Barron County, Wisconsin. Fall fingerling CPUE may also include naturally reproduced walleye.

Year	Length (in)	Number Stocked	Stocking rate (no/acre)	Fall Electrofishing (YOY/mile)
1990		0		29
1997	< 3	46,025	25	11
1998		0		10
1999		0		36
2000	< 3	110,469	60	58
2002	< 3	92,050	50	25
2003		0		14
2004	< 3	138,059	75	67
2005		0		67

Table 2. Projected angling pressure (hrs/acre), 2005-2006, Red Cedar Chain of Lakes, Barron County, Wisconsin.

Season	Red Cedar	Hemlock	Balsam
Open water	28.4	49.5	43.1
Ice	3.4	27.7	10.2
Total	31.8	77.2	53.3

Table 3. 2005-2006 creel survey data by season for major game and panfish species, Red Cedar Chain of Lakes, Barron and Washburn Counties, Wisconsin.

Species	Lake	Directed Effort %	Catch rate (hr/fish)	Harvest rate (hr/fish)	Mean len. (in) harvested
Walleye	Red Cedar	26.7	4.4	10.0	17.0
	Hemlock	2.9	0.0	0.0	0.0
	Balsam	12.5	18.4	68.1	16.9
Smallmouth Bass	Red Cedar	16.7	1.6	30.2	16.5
	Hemlock	4.9	7.9	0.0	0.0
	Balsam	14.4	2.0	0.0	0.0
Largemouth bass	Red Cedar	11.0	2.3	76.6	14.0
	Hemlock	17.7	0.5	31.6	15.2
	Balsam	15.6	2.6	62.6	14.8
Northern pike	Red Cedar	7.3	5.3	21.6	23.8
	Hemlock	16.5	3.5	16.9	22.1
	Balsam	15.7	3.1	19.5	21.6
Bluegill	Red Cedar	16.7	0.2	0.9	7.5
	Hemlock	37.0	0.2	0.5	7.2
	Balsam	18.6	0.5	1.3	7.6
Black crappie	Red Cedar	5.5	2.6	5.0	9.3
	Hemlock	18.9	0.9	1.8	9.6
	Balsam	11.9	3.5	4.6	10.2
Yellow perch	Red Cedar	9.9	1.2	4.8	10.3
	Hemlock	0.0	0.0	0.0	8.3
	Balsam	4.6	0.8	1.8	8.1

Table 4. Walleye mean length (in) at age, 1992, 2005 Red Cedar Lake, Barron County, Wisconsin.

Age	N	Red Cedar Lake Mean 2005	SD	Age	N	Red Cedar Lake Mean 1992	SD
2	15	10.7	0.6	2	16	11.6	N/A
3	35	13.6	1.2	3	16	12.9	N/A
4	47	15.5	1.3	4	29	14.5	N/A
5	33	18.0	1.2	5	45	15.9	N/A
6	21	19.3	1.2	6	18	17.4	N/A
7	13	20.6	1.5	7	20	18.9	N/A

Table 5. Walleye mean length (in) at age, Red Cedar Lake 2005, and local and regional means, Wisconsin. Local and regional mean length information is from WDNR Fisheries and Habitat database.

		Red Cedar Lake Mean 2005	Barron & Polk County (Local Mean)	Northern Region (Regional Mean)
Age	4	15.5	15.4	14.1
	5	18.0	17.5	16.1
	6	19.3	18.8	17.7
	7	20.6	20.4	19.3

Table 6. Smallmouth bass mean length (in) at age, Red Cedar Lake 2005, and local and regional means, Wisconsin. Local and regional mean length information is from the WDNR Fisheries and Habitat database.

		Red Cedar Lake Mean 2005	Barron & Polk County (Local Mean)	Northern Region (Regional Mean)
Age	3	11.1	9.9	9.2
	4	13.3	11.9	11.1
	5	14.8	14.5	13.3
	6	16.0	15.2	15.0
	7	16.7	16.8	15.9

Table 7. Largemouth bass mean length (in) at age, Red Cedar Lake 2005, and local and regional means, Wisconsin. Local and regional mean length information is from the WDNR Fisheries and Habitat database.

		Red Cedar Lake Mean 2005	Barron & Polk County (Local Mean)	Northern Region (Regional Mean)
Age	3	10.5	9.3	9.0
	4	13.0	11.7	11.0
	5	14.1	13.2	14.1
	6	15.1	14.9	14.6
	7	15.7	16.6	16.0

Table 8. Projected bluegill harvest per acre of ten northwestern Wisconsin Lakes.

Lake	County	Year	N/acre
Hemlock	Barron	2005	90
Balsam	Polk	2005	34
Lower Turtle	Barron	2004	27
Bear	Barron	2000	23
Half Moon	Polk	2006	19
Balsam	Washburn	2005	16
Big Butternut	Polk	2003	16
Beaver Dam	Barron	2006	15
Red Cedar	Barron	2005	9
Pipe	Polk	2004	5

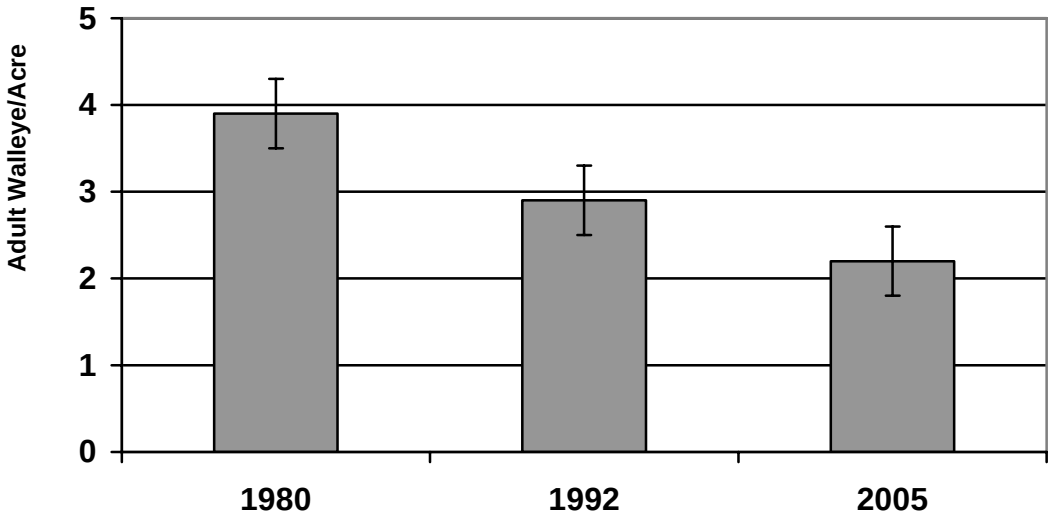

Figure 1. Adult walleye abundance, Balsam and Red Cedar Lakes combined, Barron and Washburn Counties, Wisconsin.

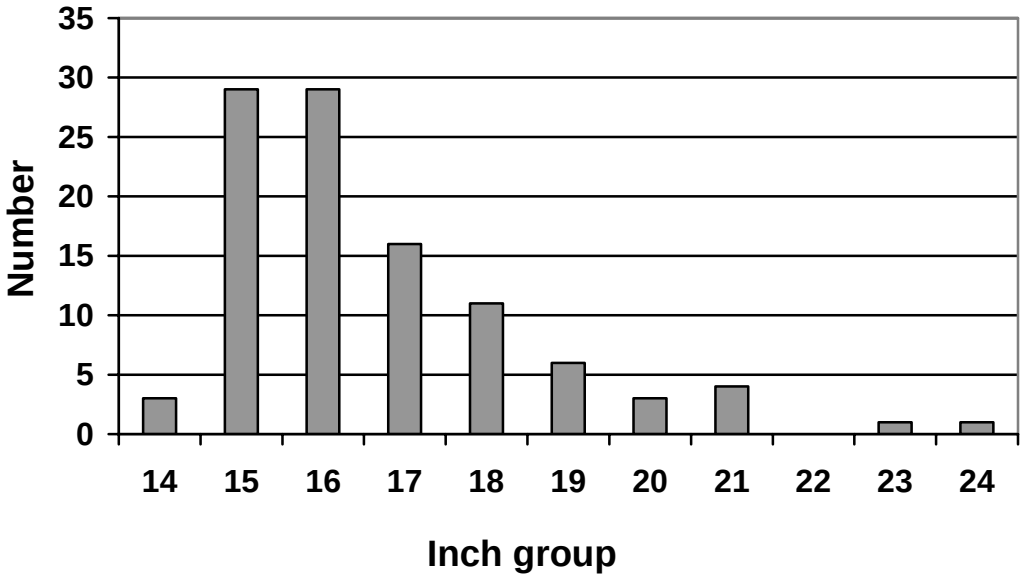

Figure 2. Length frequency of walleye harvested 2005-2006, Red Cedar Lake, Barron County, WI.

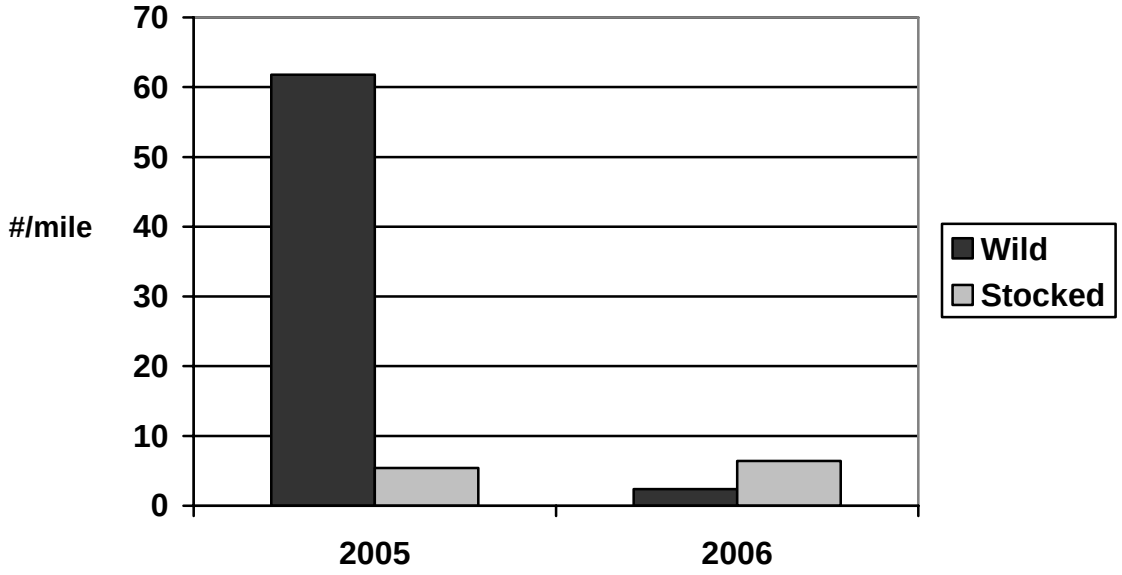

Figure 3. 2005-2006 YOY walleye collected (fish/mile) from natural reproduction (wild) and supplemental fry stocking (stocked) using a portable fish hatchery (Walleye Wagon), Red Cedar Lake, Barron County, WI.