Rainy Lake Open-water Creel Survey: 2010–11

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District Update 2012-01

Introduction

An open-water creel survey was conducted on the Ontario portion of Rainy Lake from May 15th (the opening of the walleye-angling season) until September 30th, 2010 and from May 21st until September 30th, 2011. Survey results were compared with previous creel surveys conducted from 1956–86 (McLeod 1988), 1994–95 (McLeod 1996), and 2001–02 (McLeod 2003).

The 2010–11 survey covered all the Ontario waters of Rainy Lake (70,150 ha), which has been divided into three basins (North Arm, South Arm and Redgut Bay) for fisheries assessment and management purposes (Figure 1). This is largely based on observed differences in physical and chemical characteristics, fish community composition, and user group patterns. Similar surveys were conducted annually in the Minnesota waters of Rainy Lake (21,950 ha) until 2011 (Vondra 2012).

Methods

A roving creel survey design with non-uniform probability sampling (Malvestuto *et al.* 1978) was employed. FISHNET 2.0 (Lester and Korver 1996) was used to generate effort and harvest estimates and to analyze fish attribute data from the angling harvest.

Spatial and temporal stratification were applied to the survey period. The three basins were sub-divided into seven smaller sampling units or sectors (Figure 1), in order for survey crews to conduct an instantaneous boat count within a random one-hour period. Equal priority was assigned to each basin, but sampling effort was stratified amongst the sectors.

The creel survey period was comprised of three distinct seasons: spring (May 15th (21st) to June 30th); summer (July 1st–August 15th); and fall (August 16th–September 30th). Angling effort and sampling intensity differed between workdays (weekdays) and non-workdays (weekends and holidays). A 12-hour sampling day, running from 08:00 to 20:00 hours, was divided into two time periods, corresponding to observed differences in angling effort: an a.m. period from 08:00 to 14:00 hours, and a p.m. period from 14:00 to 20:00 hours. Only one spatial and temporal unit was sampled during each survey day. Effort probabilities were based on observed distributions of angling parties (boats) from the previous season and compared to previous surveys. This information helped to determine the number of areas and time periods to be sampled in a particular season. Sampling days and areas were randomly selected for each.

A subsample of anglers, which was proportional to the time available to cover a sampling unit, were interviewed by the survey crew during each sample day. The total number of angler-hours fished per boat, the residency of anglers, their visitor type and base of operations (e.g. guest of a Canadian or U.S. commercial resort, cottager, houseboat, etc.) were recorded. All fish kept by anglers were tallied, subsampled for total length, fork length and round weight, and appropriate tissues for age interpretation (Mann 1993).

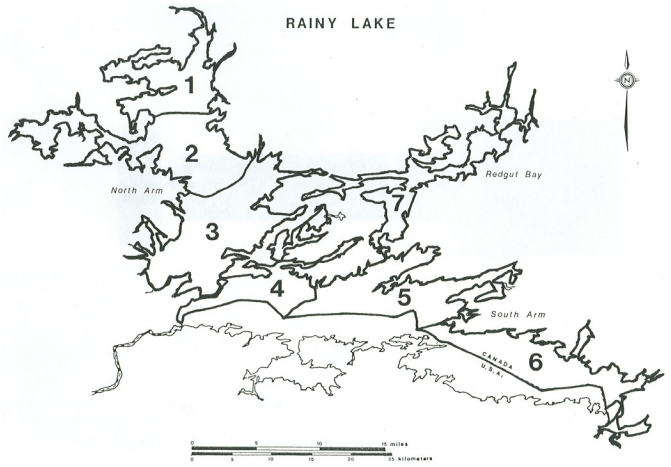

Figure 1. Location of creel survey sectors on Rainy Lake, Ont.

Results and discussion

Effort

A total of 99 days were sampled on the South Arm and Redgut Bay in 2010 compared to 100 days on the North Arm in 2011. Over the two survey years, 1,659 angling parties were contacted and 3,989 anglers were interviewed on Rainy Lake.

Angling effort for the survey period was estimated at 231,240 angler-hours ± 19,305 (at a 95% confidence level) or 3.3 angler-hours·ha^{-1}. This was 24% lower than the previous open-water creel estimate of 302,470 angler-hrs in 2001–02 (Figure 2; McLeod 2003).

Differences were observed in angling effort between basins but overall patterns remained similar to those observed during recent open-water surveys (Table 1). Greatest effort occurred in the North Arm (83,900 angler-hrs), followed by the South Arm and Redgut Bay. There is a trend to increased angling effort in the North Arm (Sectors 1, 2, 3) in close proximity to Fort Frances, and a decline in effort in the South Arm (Sectors 4, 5, 6). Angling effort in Redgut Bay (Sector 7) remained similar to past surveys, but well below the levels observed in 1992. Effort was lower after implementing new walleye size limits and reduced daily catch limits for Minnesota-based anglers in 1994 (Table 1). However, estimated effort in the South Arm has increased following the elimination of the Border Waters Conservation Tag program in 2000; it went from 59,300 angler-hrs in 1994 to 127,240 angler-hrs in 2001, and 80,510 angler-hrs in 2010.

Redgut Bay (8.0 angler-hrs·ha·$^{-1}$) continues to be the most heavily fished basin on the lake based on past creel surveys, but is below the peak angling intensity observed in 1992 (12.6 angler-hrs·ha·$^{-1}$). In 2010–11, angling intensity ranged from 2.4 angler-hrs·ha·$^{-1}$ in the North Arm to 3.0 angler-hrs·ha·$^{-1}$ in the South Arm (Table 2).

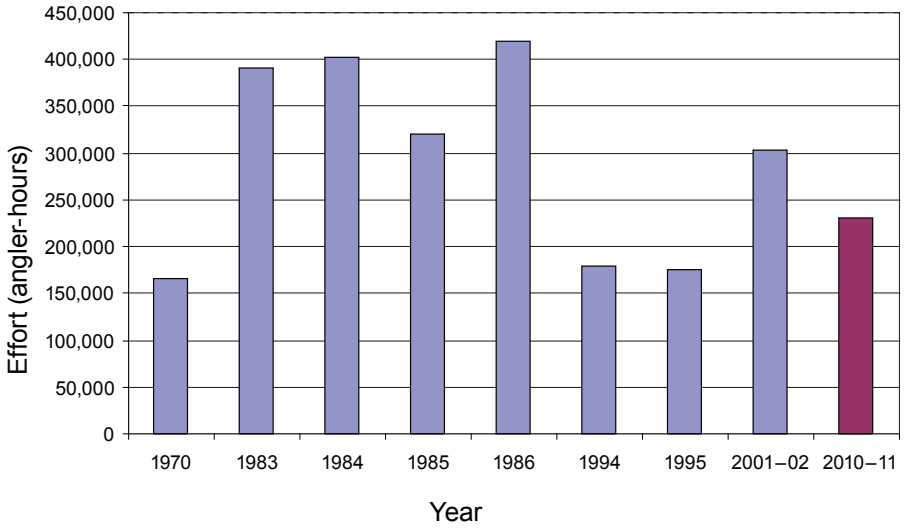

Figure 2. A comparison of estimated angling effort (angler-hrs) during May–September 1970 to 2010–11, Rainy Lake, Ont.

Year	Sector			Total	95% C.L.
	North Arm	South Arm	Redgut Bay		
1992	-	128,979	104,711	-	-
1994	67,257	59,296	52,224	178,777	15,590
1995	45,503	64,010	65,196	174,709	18,954
2001–02	101,499	127,237	73,733	302,469	33,586
2010–11	83,898	80,506	66,837	231,241	38,610

Table 1. Angling effort (angler-hrs) for various sectors estimated during open-water creel surveys from 1992–2011, Rainy Lake, Ont.

	Sector			
	North Arm	South Arm	Redgut Bay	Total
Surface area (ha)	34,570	27,260	8,320	70,150
Effort (angler-hrs·ha^{-1})	2.4	3.0	8.0	3.3
Yield (kg·ha^{-1})				
All species	0.28	0.26	1.03	0.36
Walleye	0.16	0.17	0.47	0.20

Table 2. Angling intensity (angler-hr·ha^{-1}) and yield (kg·ha^{-1}) for various basins of Rainy Lake, Ont., during May–September 2010–11.

Harvest

Total angling harvest of sportfish was estimated at 25,100 kg, and was much lower than the estimated 40,860 kg in 2001–02 and 31,040 kg in 1995 (Figure 3). Walleye represented 60% of the total harvest by number and 55% of the total harvest by weight in 2010–11 (Table 3, Figure 4). This species continued to dominate the angling harvest in all three basins. It was estimated that 25,260 walleye totaling 13,890 kg, were harvested during the 2010–11 survey; similar to the 2001–02 estimate of 25,500 fish or 14,790 kg. Estimated walleye harvest increased by 330% on the North Arm but declined in the other two basins, especially the South Arm (-45%) compared to 2001–02.

Angling yields during the survey period averaged 0.36 $kg \cdot ha^{-1}$ for all species and 0.20 $kg \cdot ha^{-1}$ for walleye. Overall yields ranged from 0.26 $kg \cdot ha^{-1}$ in the South Arm to 1.03 $kg \cdot ha^{-1}$ in Redgut Bay (Table 2). Walleye angling yields ranged from 0.16 $kg \cdot ha^{-1}$ in the North Arm to 0.47 $kg \cdot ha^{-1}$ in Redgut Bay.

Northern pike were the second most important species, representing about 23% of the estimated harvest weight (Figure 4), followed by black crappie (15%), and smallmouth bass (7%). While walleye formed the majority of the harvest from all three basins, black crappie were an important species harvested in Redgut Bay, representing about 36% of the total harvest estimate.

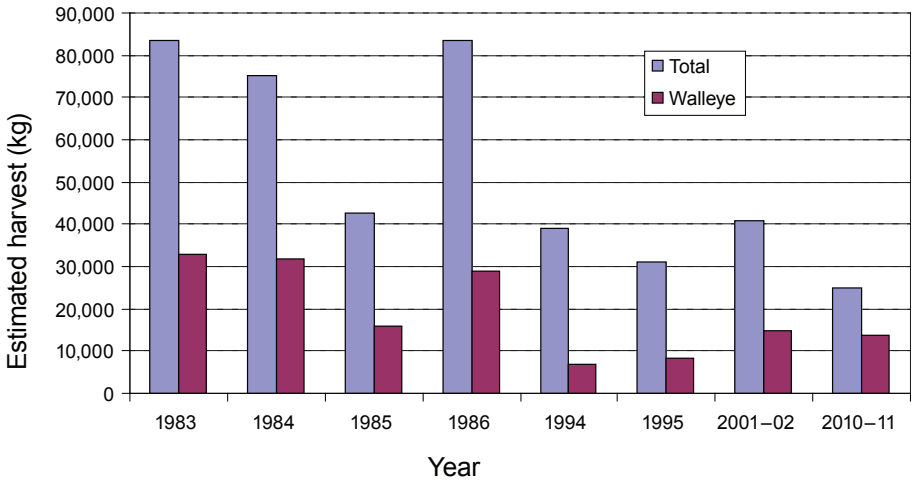

Figure 3. A comparison of total harvest (kg) and walleye harvest (kg) estimated during open-water creel surveys, May–September 1983–2011, Rainy Lake, Ont.

Basin	Estimated harvest by species (kg)					
	Walleye	Sauger	N. Pike	SM Bass	Crappie	Total
North Arm	5,397	18	3,013	865	232	9,525
South Arm	4,570	11	1,270	728	398	6,977
Redgut Bay	3,920	43	1,414	99	3,120	8,596
Total	13,887	72	5,697	1,692	3,750	25,098

Table 3. Estimated harvest (kg) by species for each basin of Rainy Lake, Ont during May–September 2010–11.

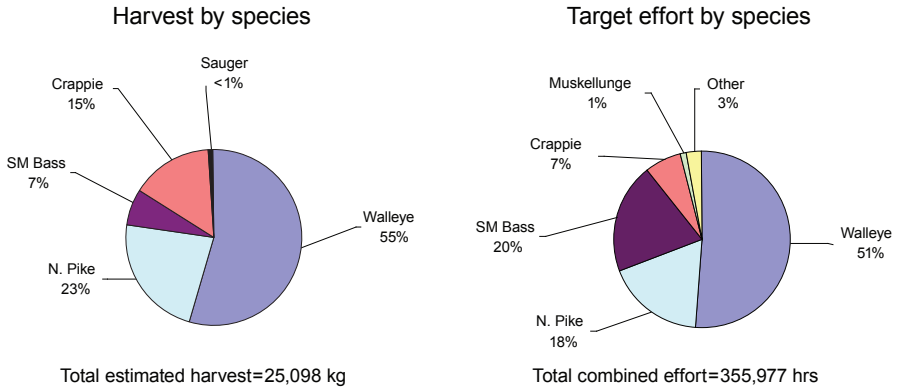

Figure 4. Percentage of total harvest and angling effort targeted by species during the 2010–11 open-water creel survey, Rainy Lake, Ont.

Catch-per-unit-effort (CUE) and harvest-per-unit-effort (HUE)

The observed average angling success for each fish species caught was estimated based on the reported catch and hours fished for interviewed anglers (Table 4). The lake-wide CUE is based on the weighted average of all three basins. An overall CUE (includes all fish species) of 1.58 fish caught·angler-hr^{-1}, with a corresponding HUE of 0.18 fish kept·angler-hr^{-1}, were slightly higher than 2001–02 values (i.e. CUE of 1.49 fish caught·angler-hr^{-1} and an HUE of 0.18 fish kept·angler-hr^{-1}). Walleye CUE and HUE averaged 0.98 fish caught·angler-hr^{-1} and 0.14 fish kept·angler-hr^{-1} throughout the lake, as compared to 0.67 fish caught·angler-hr^{-1} and 0.10 fish kept·angler-hr^{-1} in 2001–02. Walleye catch rates have increased over time and currently range from to 0.78 fish·angler-hr^{-1} on the North Arm to 1.34 fish·angler-hr^{-1} in Redgut Bay (Figure 5). Walleye harvest rates were consistent across the three basins at 0.14 fish kept·angler-hr^{-1}.

It was estimated that anglers released 89% of all walleye reportedly caught in 2010–11, compared to 87% in 2001–02, 82% in 1994–95, and 47% in 1992 (Figure 6). Slightly higher walleye release rates in 2010–11 may reflect the increasing abundance of both smaller walleye (<35 cm) and larger walleye (>45 cm) in the population, and better compliance with the existing harvest slot/trophy size limit in place since 1994. Release rates for most other fish species were high (93–100%), other than black crappie at 32% (Figure 6).

Angler characteristics

Residency and base of operations

An estimated 73% of all anglers contacted during the 2010–11 creel survey were non-residents of Canada, while 27% were residents of Ontario and Canada. The majority (57%) of non-resident anglers were based in Ontario using a resort, cottage, or camping on Crown land. The representation of Minnesota-based non-residents or day-trippers has increased in recent surveys, from 8% in 1994, to 14% in 2001–02, and 16% in 2010–11. In 1983, this group represented a high of 51% of the anglers contacted in the Ontario waters of Rainy Lake and up to 81% on the South Arm. The proportion of this angler group varies across basins of the lake, with the highest representation at 33% on the

Basin	Estimated CUE by species (no. caught/hr)					
	Walleye	Sauger	N. Pike	SM Bass	Crappie	Muskellunge
North Arm	0.78	0.18	0.48	0.64	0.20	-
South Arm	1.12	0.51	0.49	0.69	0.30	0.06
Redgut Bay	1.34	0.41	0.38	0.55	0.52	0.03
Rainy Lake	0.98	0.34	0.47	0.65	0.28	0.05

Table 4. Estimated catch-per-unit-effort (CUE) by targeted fish species for each basin of Rainy Lake, Ont. during May–September 2010–11.

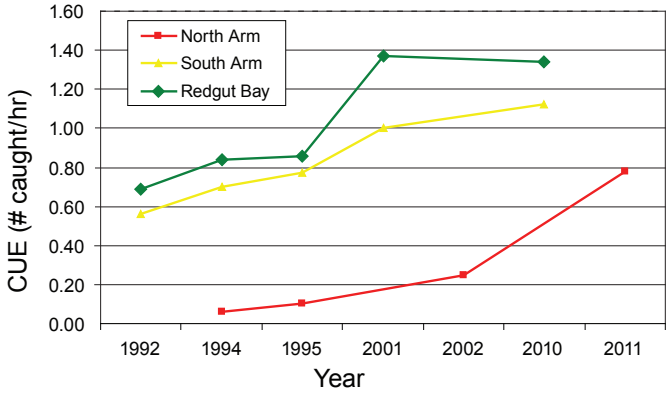

Figure 5. Walleye angling CUE's during the 1992 to 2010–11 open-water creel surveys, Rainy Lake, Ont.

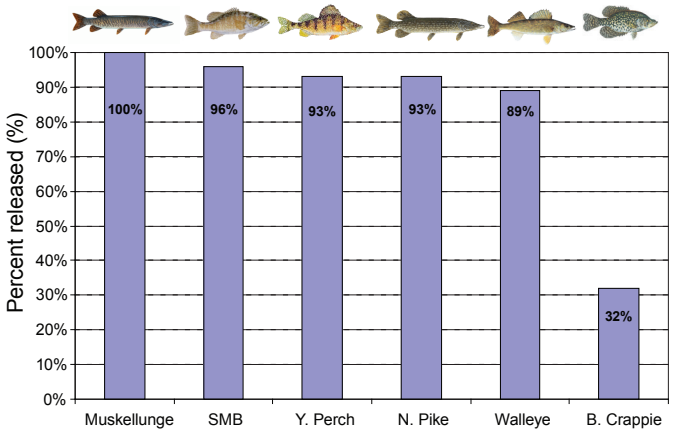

Figure 6. Percentage of fish released by species during the 2010–11 open-water creel survey, Rainy Lake, Ont.

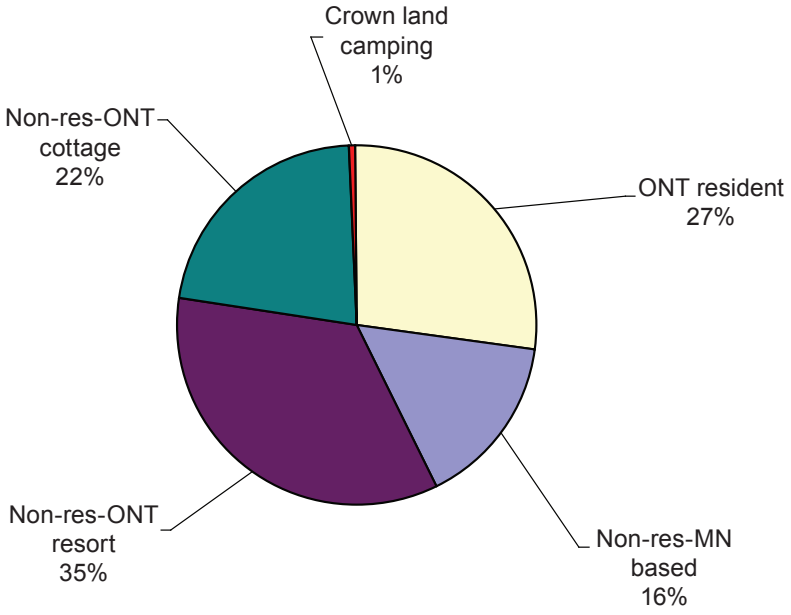

Figure 7. Residency and base of operations of anglers interviewed during May–September 2010–11, Rainy Lake, Ont.

South Arm, compared to 11% on the North Arm and only 6% on Redgut Bay.

The single largest group of anglers interviewed (Figure 7) was identified as non-resident guests of Ontario resorts, representing 35%. This is consistent across all three basins of the lake. While this angler group has declined in recent years, non-resident cottagers have steadily increased their representation in this fishery from about 11% in 1983 to 22% in 2010–11. Similarly, the proportion of resident anglers continues to increase from 9% in 1983 to a high of 27% in 2010–11, with most of these anglers using the fishery on a day-use basis.

Species preference

Walleye were the most sought after species by anglers in all three basins of the lake, accounting for over 51% of all targeted (combined) angling effort during the 2010–11 survey (Figure 4). They were followed by smallmouth bass (20%), northern pike (18%) and black crappie (7%). Muskellunge angling, which represented 1% of all targeted effort, was most important in Redgut Bay where effort for this species accounted for 4%. Since many anglers report targeting multiple species during a fishing period, the actual proportion of effort targeted at each species is significantly higher. Across the entire lake in 2010–11, an estimated 79% of angler effort was directed at walleye, followed by 31% for bass, 28% for pike, 10% for crappie, and 2% for muskellunge. Since many anglers target more than one fish species, the sum of these values exceeds 100%.

Age and size composition of the harvest

Walleye

Walleye (n=513) averaged 395 mm total length (range 280–721 mm), 0.56 kg in weight, and 5.7 years of age in the observed angling harvest sample. Fish tended to be larger and slightly older than those sampled during previous surveys including the 2001–02 open-water survey (Figure 8; McLeod 2003). The majority of fish were within the current harvest slot size of 350–450 mm in length and 4–8 years of age. Similar to previous surveys, a single strong year-class has dominated the angler catch. The combined 2010–11 walleye catch was dominated by 5-year-olds at 52%, with the majority of these fish sampled from the North Arm in 2011. These walleye would represent the 2006 year-class event. The 2001 year-class, which has been the strongest year-class ever observed in assessment programs in Ontario and Minnesota water, still comprised 4% of the angler catch as 9-year-olds in 2010 and 10-year-olds in 2011. However, the majority of the fish from this year-class would have exceeded 450 mm and the upper limit of the existing harvest slot. Of the 513 walleye sampled, 21 walleye were in the protected size range (450–700 mm) and 14 were in the lower protected size range (<350 mm) (Figure 9). This provided an estimated non-compliance rate of 6.8% based on voluntary reporting. Only one walleye was sampled over the trophy size of 700 mm.

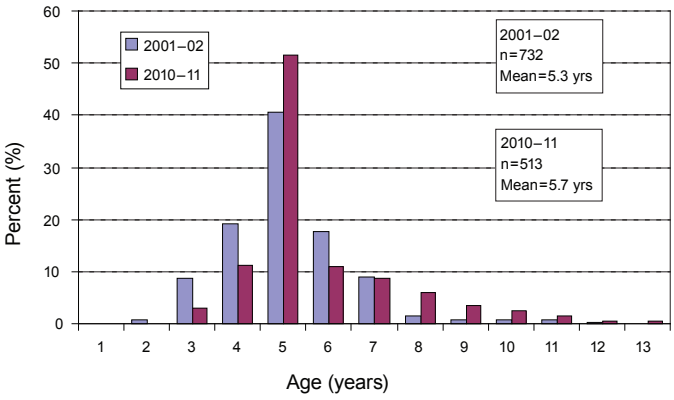

Figure 8. Age composition of walleye harvested by anglers during May–September in 2001–02 and 2010–11, Rainy Lake, Ont.

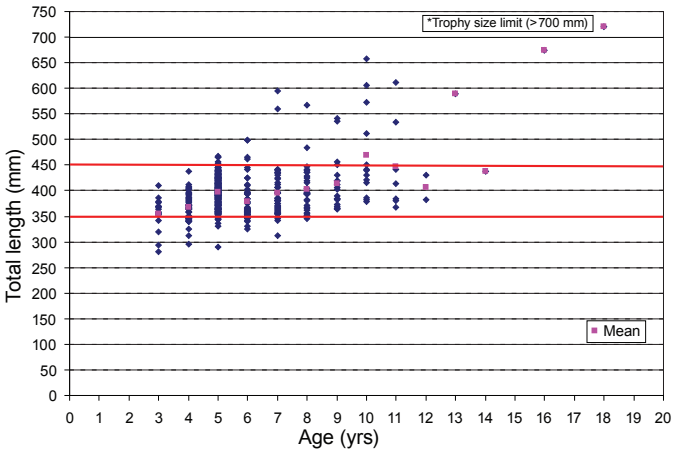

Figure 9. Total length at age for walleye harvested by anglers during May–September in 2010–11, Rainy Lake, Ont.

Other species

Limited numbers of other species in the observed angling harvest were sampled for size and age characteristics (Table 5). Smaller sample sizes generally restricted more detailed comparisons between survey years. Similar to walleye, the voluntary non-compliance rate reported for northern pike in the protected size limit (700–900 mm) was 5.9% (6 of 107 fish). No fish over the 900 mm were sampled in the angler harvest.

Table 5. Catch statistics for various species sampled in the angler harvest during the 2010–11 open-water creel survey, Rainy Lake, Ont.

Species	Sample size (n)	Average			Range	
		Total length (mm)	Weight (g)	Age (yrs)	Size (mm)	Age (yrs)
Walleye	513	395	563	5.7	280–721	3–18
N. Pike	107	622	1,431	5.3	420–894	3–10
SM Bass	50	341	663	6.0	235–473	3–12
B. Crappie	100	291	473	6.1	226–368	3–12
Sauger	5	343	335	6.6	262–391	4–11

Conclusion

Angling effort in 2010–11 declined since the 2001–02 survey but remains higher than the levels observed in 1994–95. However, current levels of effort are still much lower than those observed during the 10-year period from 1982–1992, prior to the implementation of reduced catch and possession limits for Minnesota-based anglers under the Border Waters Conservation Tag program. This program and associated border waters area regulations were later revised in 2000. Strict walleye size limit regulations also came into effect in 1994 and may have affected the levels of fishing activity in subsequent years.

Although there was an increase in effort across the lake in 2001–02 (McLeod 2003), this trend did not continue in 2010–11 particularly for the South Arm and North Arm. Effort in Redgut Bay remained relatively consistent over this period, and remains the most intensively fished area in Ontario waters. Recent downturns in the economy, particularly in the U.S., have likely contributed to reduced levels of fishing effort on Rainy Lake where 73% of anglers are non-residents of Canada.

There has been increased participation in the fishery by non-resident day-trippers, from a low of 8% in 1994 to 14% in 2001–02, and 16% in 2010–11. This may be responsible for increased pressure since 1994, especially on the South Arm where 33% of the anglers are Minnesota-based. This has paralleled an increase in use by Ontario residents from a low of 9% of all anglers in 1983 to 27% in 2010–11. Resident effort (angler-hrs) has almost doubled over this period as the local fishery improved. Redgut Bay continues to account for the highest representation of this user group at 31% (>20,000 angler-hrs).

Release rates for most species are very high and continued to increase in 2010–11. Overall harvests of fish, including walleye, were similar to the 2001–02 estimates, with the exception of northern pike which declined by 70%. Average catch rates of all fish species (1.58 fish·angler-hr^{-1}) and harvest rates (0.18 kg·angler-hr^{-1}) were slightly higher than in recent surveys,

including 2001–02. Meanwhile, walleye catch rates (CUEs) represent "very good" walleye fishing and have continued to increase since 1992 as the populations improved on all three lake basins. As a result, the average age and abundance of older, larger walleye in the angler catch and harvest has increased. This improvement has been attributed to the reduced harvest levels, lower fishing effort, effective compliance and good natural recruitment of walleye from several strong year classes, especially 2001. Current angler yields of walleye and other fish species remain below safe harvest levels, and the management objectives outlined in the Ontario-Minnesota Boundary Waters Fisheries Atlas (OMNR 2004).

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